ICAR - CIFT Technology Advisory Series - 16

REQUIREMENTS FOR A MINI FISH PROCESSING UNIT

(for small scale entrepreneurs, self-help groups and co-operatives)



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ISBN No : 978-81-930245-3-9

Published by
Dr. C.N. Ravishankar
Director, ICAR-Central Institute of Fisheries Technology, Kochi

Citation
B. Madhusudana Rao, George Ninan, A.A. Zynudheen, C.O. Mohan, M.M. Prasad, K. Ashok Kumar, C.N. Ravishankar (2015) Requirements for A Mini Fish Processing Unit.
ICAR-CIFT Technology Advisory Series -16.

Price: Rs 250/-
Technical assistance : A.K. Panigrahi, Thampi Pillai
Cover Design : Razia Mohamed

Printers : PrintExPress, Cochin - 682 017

1.0 Introduction

Fish is a nutritionally versatile food product. Fish lipids contain less of saturated fat but are rich in long chain polyunsaturated fatty acids (PUFA). The Omega 3 fatty acids viz., eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) play a very important role in brain development and prevention of thrombotic problems and lower the risk of developing irregular heart rhythms. Consumption of fish has been shown to associate particularly with lower risk of sudden cardiac death and has been linked to a significant decrease in age related memory loss. The advantage of fish is that it is very easily digestible. The protein content varies between 15 to 20%. Fish proteins contain all the essential amino acids in required proportion. Fish proteins improve the blood lipid profile in animals and humans. Fish meat is a good source of B vitamins and species with significant amounts of liver oils are good sources of vitamins A and D. Fish meat is a valuable source of calcium, phosphorus, iron, copper and trace elements like selenium and zinc. Salt water fish contain high levels of iodine. Fish is recommended as a nutritious food and consumption of fish should be encouraged.

A mini fish processing unit is intended for the benefit of fishers and small scale entrepreneurs. It can be utilized for production of value added products such as fish fillets, fish steaks, fish pickles, fish wafers, fish cutlets, fish balls, fish noodles, fish fingers, dried fish etc. The facility can be used as a training and demonstration centre. The mini fish processing unit provides a source of income to the fishers and at the same time encourages fish consumption by the local consumers.

The mini fish processing unit has the following objectives

1. Better utilization of fish so as to help fishers for better price realization.
2. Make value added fish products available to local consumers with a goal to increase fish consumption by the public.
3. Supporting women fishers in growth of entrepreneurial skills so as to generate sustainable income.
4. Mini fish Processing unit might additionally function as a training-cum demonstration centre for interested fishers and small scale entrepreneurs.

2.0 Basic infrastructure required for mini fish processing unit:

The following facilities are essential for establishing and proper functioning of mini fish processing facility:

1. Processing hall of 20'x 30' with smooth flooring and preferably with RCC roofing for housing different processing equipments and processing the fish in to value added fish products. The roof has to accommodate and bear the weight of overhead water tank and solar panels of fish dryer. The room should have adequate lighting and ventilation in the processing hall.
2. A change room with hand wash facility has to be provided at the entrance to the main processing hall.
3. A storage cum retail sale counter for storing the finished value added fish products and displaying them for sale to the consumers has to be provided at a suitable place either close to the main fish processing hall or at a place which is easily accessible to the consumers.
4. Continuous power supply (3 phase) as the facility will be housing deep freezers which have to be maintained at -18°C.
5. Adequate potable water supply for ice production, cleaning of fish and for washing purposes.
6. Overhead tank for water storage.

3.0 Model Layout of mini fish processing unit:

The mini fish processing unit can be established as a new structure or existing buildings may be suitably modified. However, the layout should meet certain criteria for use as mini fish processing unit. The aim of the layout should ensure unidirectional flow of material so that the quality of the finished products is not compromised. The raw material (whole fish/shrimp) should enter from one end and the finished products (fish fillets, fish steaks, fish pickles, fish wafers, fish cutlets, fish balls, fish noodles, fish fingers etc.) should leave from the other end of the processing hall.

The layout (Fig. 1) of the mini fish processing unit comprises of three sections;

i. Main processing hall which houses all the processing equipment where the fish is handled and the value added products are prepared;

ii. Change room where workers wear their uniform and other safety wares before entering the processing hall;

iii. Storage-cum-retail sale counter where the finished products are stored and displayed for sale.

The main processing hall is the most important structure. It should be constructed/modified to meet the following features.

1. Floor has to cemented and covered with tiles for easy cleaning. Gradient of the floor should slope towards one side and provided with covered drain. The exit end of the drain has to be covered with wire mesh to prevent entry of rodents.

2. A side platform of 3 feet height from the ground has to be provided. The platform has to be covered with marble / granite and should be able to bear the weight of the processing equipments.

3. The entrance of the main hall should have self-closing door.

4. Windows and exhausts should be provided for ventilation. They should be made fly proof by covering them with wire mesh.

5. Water line with sufficient number of taps should be provided. One hose connection with non-returnable valve (NRV) should be provided.

6. Fly catchers to be provided in the main hall to kill insects.

7. Change room has to be constructed at the entrance of the main processing hall. A self-closing door and air curtain have to be fixed at the entrance to prevent entry of flies. Cupboards with locking facility for keeping uniforms and valuables should be provided. A hanger for hanging street clothes should be provided. In this room, a wash basin with foot operated tap should be provided near the entry to the main hall. The room should have a door opening into the main processing hall. A foot dip (as wide as the door with 6" depth) should be provided at the door opening into the main hall.

8. A storage facility-cum-retail sale counter has to be constructed for storing the finished value added fish products and displaying them for sale to the consumers. This can be constructed at the other end of the processing hall or at a suitable place which is easily accessible to the consumers. This storage facility-cum-retail sale counter houses deep freezers (-18°C) for storing fish fillet, fish cutlets, fish balls, fish fingers, and cupboards for dried fish, fish wafers, fish pickles, fish noodles. A chute has to be in the main hall for transporting the finished product to the storage facility-cum-retail sale counter. The entry to storage facility-cum-retail sale counter shall be fly proof with air curtain.

9. An overhead water tank (cement tank inside lined with tiles or plastic tank) has to be constructed/placed on the roof. Water is needed for ice production, fish processing, and washing purposes. The capacity of the water depends on the quantity of fish processed (as a rough estimate 12 litres of water is necessary for processing 1 kg of fish).

10. Waste disposal should meet the local municipal administration guidelines for food establishments.

4.0 Personnel required for Mini Fish Processing Unit

	Staff designation	Function	Strength
1.	Manager	Procurement of fish/shrimp, ingredients for value addition, packaging materials, maintains records, in-charge of the mini fish processing unit.	1
2.	Processing workers	Preparation of value added products such as fillets, steaks, cutlets, balls, fingers, wafers, dry fish, pickles etc	3
3.	Pre-processing workers	Cleaning the fish/shrimp, heading and gutting of fish, peeling of shrimp	2
4.	Cleaning staff	Washing the floors and utensils	1
5.	Salesman in the retail sale counter	For selling the value added products	1

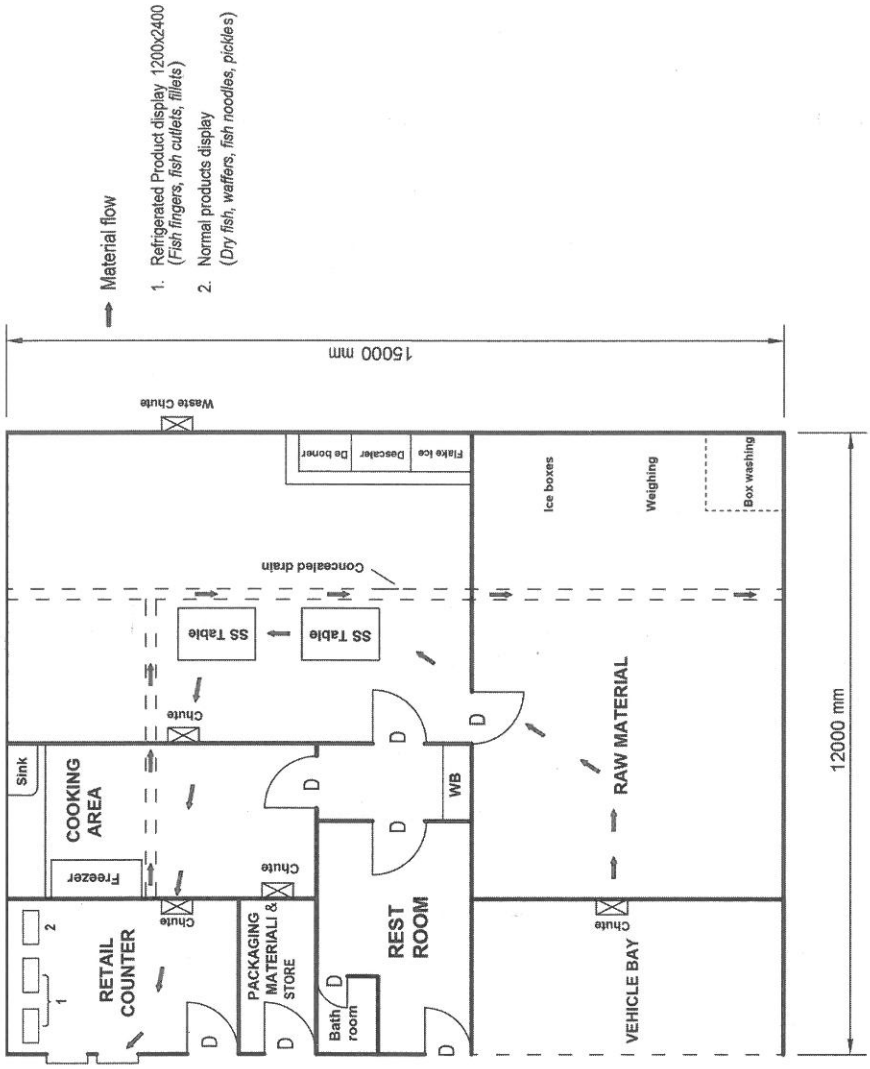


Fig.1. Layout of the mini fish processing unit

5.0 Equipments / Consumables required for Mini Fish Processing Unit

	Machine/Item	Use	Number of Units
1	Flake Ice Machine	For ice production. The fish for value added products should be maintained at a temperature of less than 4°C. As a thumb rule 2 Kg of ice is required for processing 1 Kg of fish/shrimp.	1
2	Deep Freezer (-18°C)	For storing products such as fish fillets, fish fingers, fish balls, fish cutlets. Chest type freezers can be used for storing the products. Vertical deep freezers with transparent door or horizontal deep freezers with transparent lid can be used both for storing and display of the value added products.	3
3	Meat Mincer	For mincing the fish meat for preparing value added products.	1
4	Sealing machine (Vacuum)	For sealing the dried fish or other fish products.	1
5	De-scaling machine	For removing the scales of fish.	1
6	Deboner	For separating the bones from fish meat.	1
7	Dryer (Solar with electric backup)	For hygienically drying the fish.	1
8	Electric Fryer (Thermostat controlled)	For frying battered and breaded fish products such as fish cutlets, fish balls, fish fingers	1

9	Hand operated noodles machine	For preparing noodles	1
10	Hand operated meat mincer	For mincing small quantities of fish meat.	2
11	Weighing scales	For weighing raw material, ingredients for value addition.	2
12	Hand operated heat sealers	For sealing the dried fish or other fish products.	2
13	Digital thermometers	For checking the temperature of fish during processing to see that it is maintained at less than 4°C.	2
14	Gas stove	For frying and cooking	1
15	Steamer	For steaming during wafer preparation	1
16	Utensils	For mixing ingredients	set
17	Knives (SS, different sizes)	For dressing the fish and during preparation of value added products.	set
18	Stainless Steel (304) tables	For dressing the fish and preparation of value added products.	2
19	Ice boxes	For transporting the fish from landing centre/farms and for holding the fish prior to processing.	10
20	Plastic Trays, Crates	For use in the processing hall during processing operations.	20
21	Packaging materials	For packaging the finished products. The type of packaging material and size varies with the fish product.	
22	Aprons, gum boots. Caps, mouth covers	To avoid contamination from the personnel during handling and processing of fish	

23	Air curtains	To avoid dust, flies in the processing hall	5
24	Fly catcher	To avoid flies in the processing hall and retail sale counter	2
25	Cupboard, stainless steel	Storing packaging material in the main processing hall	1
26	Cupboard, stainless steel	Keeping workers uniforms in the change room	1
27	Cupboard with transparent door	Storing and display of products such as fish pickles, dried fish, fish wafers in the retail sale counter	1

6.0 Specifications of the equipments required for Mini Fish Processing Unit:

	Equip-ment	Specification	Approx. Unit Price (Rs.)	Num ber	Total Amount (Rs.)
1.	**Flake ice machine**	Ice production capacity 300Kg/24h, storage bin 150 Kg, PUF Insulation, high density Polyethylene bin interior for easy cleaning and should resist scratches and scuffs from ice scoops robust door frame to resist operat-ional abuse, Storage bin base drain tub should rotates at 360° radius to allow ease-of-connection with any floor water drain position. R404a, CFC free refrigerant, Electrical feeding 220-230V, 50Hz.	3,50000/-	1	3,50,000
2.	**Deep freezer (-18°C)**	Storage capacity, 300L capacity, minimum temperature -18°C, Hard top, Corrosion resistant, Lockable lid, Eco-friendly	40,000/-	1	40,000

		refrigerant R-134a, Electrical feeding 220-230V, 50Hz			
3.	**Table top De-scaling machine**	Capacity : 5kg Material : Food Grade SS 304 Power : 230V AC single phase with 50Hz Drum size : 40cm length x 32 cm diameter i. with an opening of 20cm x 10cm leak proof door with suitable lock. ii. Inner surface covered with perforated SS 304 sheet with suitable projections to remove the scale Drum speed : 20-30 rpm Body frame : Fabricate in dism-antling type in 1inch square SS tube with a suitable covering in the electrical parts (Motor parts) Frame length : 1100 mm Width : 500 mm Height : 500 mm Motor : ½ HP AC motor with proper belt reduction to achieve required drum speed.	50,000/-	1	50,000
4.	**Meat mincer**	200Kg/hour, Full SS (304) body and blades, 2 piece cutting system, hole plate 4.5 mm	1,10,000/-	1	1,10,000
5.	**Fish deboner**	Stainless steel (304), drum hole size 3.2 mm, capacity 220 kg/h.	2,50,000/-	1	2,50,000
6.	**Table top vacuum**	Microprocessor based, Sensor based system for accuracy,	1,00,000/-	1	1,00,000

	packaging machine	Sturdy and heavy gauge design, Fully see through lid, User-friendly consumable replacement, Digital Display, Stainless steel contact parts, Emergency stop button, Electrical protection systems, Initial fresh air flushing for pouch protection, Power failure air intake system, Fully stainless steel option **Technical Data** Chamber dimensions (LxWxH) (mm): 400 x 450 x 120, Seal Length L2 (mm) : 360, Max pack size (mm) : 360 x 360, Number of sealing jaws : 1, Pump capacity : 20 m^3/h			
6.	**Solar dryer with electrical backup**	Stainless steel trays, 50 Kg capacity, solar panels, air heating collectors, blower fans, electrical heating system	1,25,000/-	1	1,25,000
7.	**Digital food probe thermo-meter**	Probe to be of food grade stainless steel, Battery operated, Digital LCD Display, Memory of last measure, Auto shutdown for power saving, Range -50^{0}C to + 300^{0}C measuring range, Resolution 0.1^{0}C or 1^{0}C, user selectable ^{0}C to ^{0}F conversion option.	3000/-	2	6,000
8.	**Weighing scales**	Stainless Steel Housing, SS 304 platform and frame work, Water Resistant, Digital Display, Weighing, Capacity : 15kg, accuracy 1g, Platter size 400 x 400 mm.	35,000/-	2	70,000

9.	**Fryer (thermostat controlled)**	Deep Fryer, thermostat controlled, 10kg oil capacity, Heavy 304SS with timer and regulator	40,000/-	1	40,000
10.	**SS tables**	6'x4', Stainless Steel (SS 304), Heavy Duty, 18 Gauge, Drain outlet to be provided at one corner with necessary sloping. Flexible drain pipe to be supplied along with table. One table to be provided with running water facility	40,000/-	2	80,000
11.	**Hand operated meat mincer**	Full MS body with sharp MS Blade 3kg/hour capacity	3000/-	2	6,000
12.	**Hand operated heat sealers**	12" Sealing length	3000/-	2	6,000
13.	**Ice boxes**	Should be made from food grade, FDA approved grades of polyethylene materials in double wall construction, Leak proof, rust proof and corrosion free, Strong and durable, Hygienic, Storage capacity 50L	6000/-	10	60,000
14.	**Crates/ perforated trays**	Heavy duty food grade plastic	850/-	20	17,000
15.	**Knives**	Stainless steel, different sizes	8,000/	Set	8,000
16.	**Cupboards**	Stainless steel for keeping uniforms, storing packaging materials and displaying value added products	20,000/-	3	60,000
17.	**Gas Stove**		10,000/-	1	10,000
18.	**Steamer**	Aluminium body and trays	5,000/-	1	5,000

19.	**Mixer/ Grinder**		7,000/-	1	7,000/-
20.	**Utensils**	Stainless steel	15,000/-	Set	15,000
21.	**Air curtains**	Air curtains at entry, exit points and entry to retail sales counter, Air curtain length-5feet. Air curtain (4' length) at the chutes	20,000/- 15,000/-	3 2	60,000 30,000
22.	**Fly catcher**	Regular size with good coverage, shatterproof lamps. Suitable for wall mounting or ceiling suspension	10,000	2	20,000
22.	**Aprons, gum boots. Caps/ hair nets, mouth covers, gloves**	Cloth aprons, good quality gum boots of different foot sizes, disposable caps/ hair nets, mouth covers and gloves.	15,000/-		15,000
23.	**Packaging material**	Different types and sizes for different value added products	20,000/-		20,000
		TOTAL			**15,60,000**

Requirement for Retail sale counter: A retail sale counter for storing and displaying the fish a product for sale to the consumers has to be provided at a suitable place either close to the main fish processing hall or at a place which is easily accessible to the consumers. The structural requirements of the retail sale counter are same as that of main processing hall. The entry should have a self-closing door with an air curtain. Fly catcher to be provided in the room.

1.	**Refrigerated display cabinet** SS 304 trays and body, transparent curved glass at the front, temperature display digital, LED light inside the chamber for illumination, temperature range -2C to 20°C, digital control, back side sliding doors (SS), tight closure with locking facility. 4' x 2'x 3' dimensions.	1 No.	Rs. 75,000
2.	**Freezer (-18°C)** Storage capacity, 300L minimum temperature -18°C, Chest type freezers for storing the products. Vertical deep freezers with transparent door or horizontal deep freezers with transparent lid for storing and display of the value added products.	2 No	Rs 80,000
3.	**Cupboard with transparent door** for Storing and display of products such as fish pickles, dried fish, fish wafers	1 No.	Rs 20,000
4.	Stainless steel table 3'x2' dimensions.	1No.	Rs 20,000
5.	Weighing scale 1g to 15kg,	1 No.	Rs 15,000
6.	Insulated boxes	2 Nos	Rs 20,000
7.	Two wheeler fitted with insulated box for door delivery	1 No.	Rs 60,000
		TOTAL	**Rs 2,90,000**

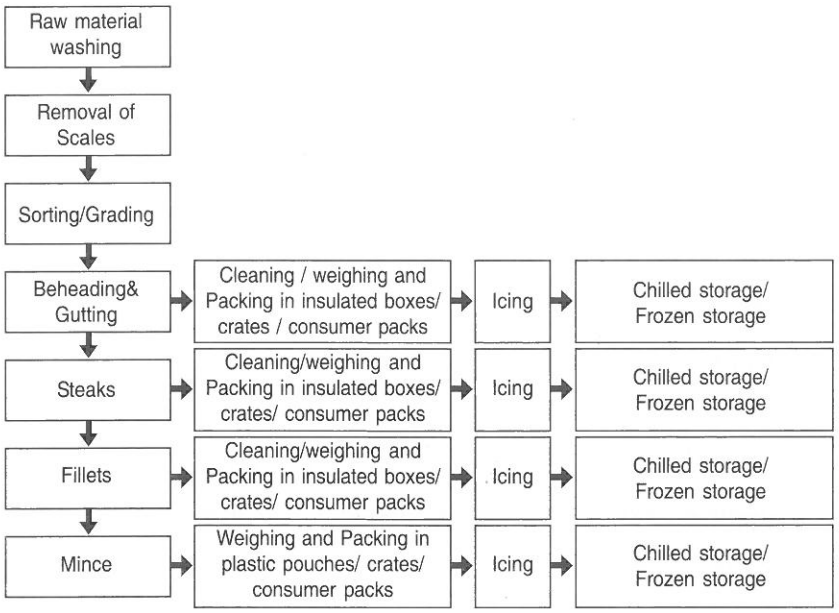
7.0 Product Profile and Process Flow

The product profile of the mini fish processing unit can be categorized into two. The first category will be chilled and frozen fish products viz., whole fish, dressed fish, steaks and fillets. The second category will be fish mince and meat based products viz., cutlets, fingers, wafers and pickle.

7.1 *Processed Fish*

Preliminary processing of fish usually consists of the following steps - evisceration or gutting, beheading, scaling, cutting of fins and belly flaps, slicing of whole fish into steaks, filleting, skinning and mincing of skinned fillets and different combinations of the above as illustrated in Fig. 2.

Fig. 2. Process Flow diagram for processed fish for chilled storage/frozen storage



7.2 *Value added fish products*

7.2.1 *Gutted fish*

Shelf life of the fish can be extended by gutting and evisceration. Care has to be taken to avoid cut or bruises on the surface of fish during handling. Sensory evaluation revealed that gutted fish retained high quality compared to whole fish at the same conditions of storage.

77.2.2 *Steaks and Fillets*

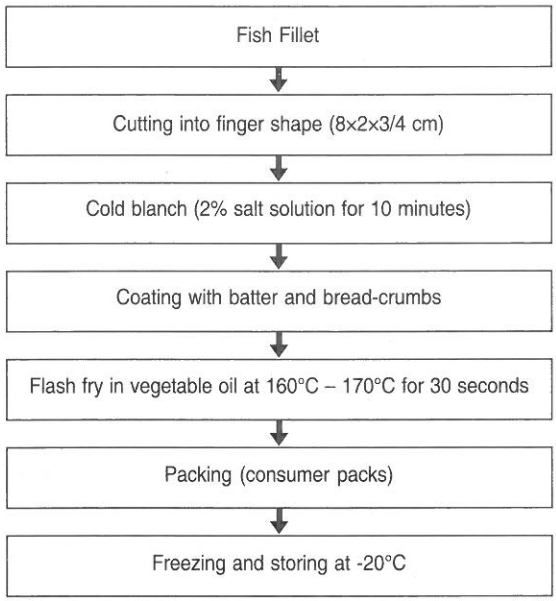
The most common form of ready to cook product of fish is steaks and fillets. The whole fish has to be gutted and the gutted fish can be cut into

steaks of 1-2 cm thickness. Fillets are prepared as skin on and skinless from the whole fish.

7.2.3 *Fish fingers*

Fish fingers prepared from the skinless fillets/portions of meat. The meat cut in the size of 8×2×3/4 cm are cold blanched in 2% salt solution for 10 minutes, drained and coated with batter and breadcrumbs. The coated fingers are then flash fried for 30 seconds and stored in frozen condition.

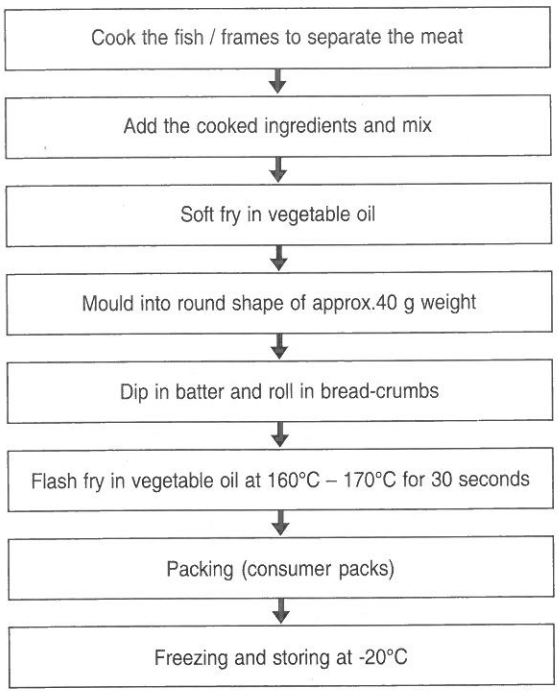
Fig.3. Process Flow diagram for preparation of fish fingers



7.2.4 *Fish cutlet*

This is a product which can be prepared from whole fish or fish mince. Fish cutlet is a highly acceptable consumer product both for urban and rural people. They can be flash fried and kept stored up to 6 months at -20°C. Frozen cutlets are to be fried in oil before consuming.

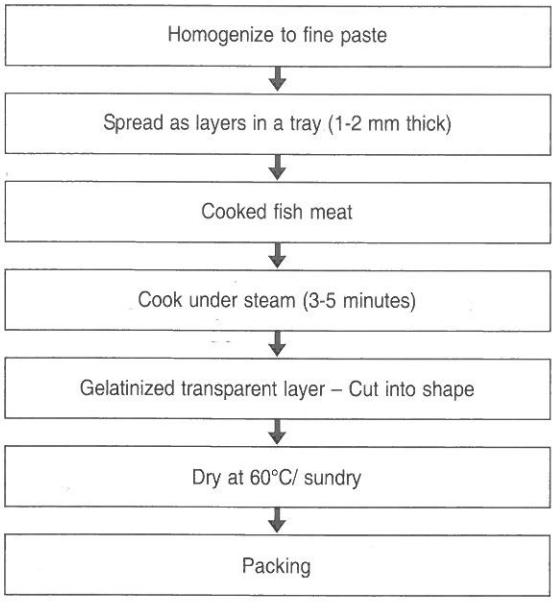
Fig.4. Process flow diagram for preparation of cutlet



7.2.5 Fish wafers

Cooked fish meat or cooked fish mince is used for preparation of flakes. Flakes are to be fried in vegetable oil kept heated around 160-170^{0}C, prior to use. Spices can be added in the final stage of processing to make it appealing to the consumers.

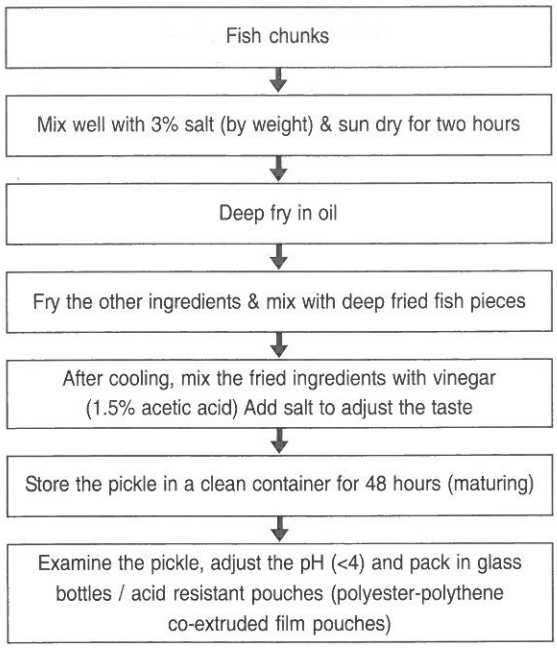
Fig.5. Process flow diagram for preparation of fish wafers



7.2.6 Fish pickle

Fish pickle is a traditional product which has wide acceptability. The ideal raw material of fish pickle would be the non- fatty variety of low value fish having good meat content. Fish meat is cut in to small pieces and mixed with 3% salt and sun dried for two hours. The semidried meat pieces are then deep fried in gingelly oil and mixed with other fried ingredients. After cooling, sufficient quantity of vinegar is added, salt adjusted and kept at least for two days for proper mixing of ingredients and adjustment of pH. The pickle is then packed in airtight containers / stand-in pouches for consumer use.

Fig.6. Process flow diagram for preparation of fish pickle



8.0 Product economics

Raw material : Locally available fish; either freshwater fish or marine fish

Average yield of steaks, fillet, mince, skeletal frame and cooked meat from skeletal frame

Steaks from whole fish	60-65%
Fillet from whole fish	35 %
Mince from fillet	96 %
Skeletal frame	20 %
Cooked meat from skeletal frame	50 %

Production costs and Profitability index of value added fish products*

A. Fish finger (175 kg/day)		
Raw material cost (Fish fillets 100 kg)	Rs	11200/-
Cost of pre-dust, batter, breadcrumbs, oil etc.	Rs	5000/-
Fuel /electricity /water	Rs	1500/-
Packaging material	Rs	2000/-
Wages	Rs	2000/-
Interest on investment (25% share)	Rs	3140/-
Marketing and Sales promotion @ 30%	Rs	7450/-
Total cost	Rs	32290/-
Cost/Kg	Rs	185/-
Selling Price/Kg	Rs	222/-
Revenue (222 x 175)	Rs	38850/-
Profit/day	Rs	6560/-
Profit (300days x 6560)	Rs	1968000/-
B. Fish Pickle (130kg/day)		
Raw material cost (Fish fillets 100 kg)	Rs	11200/-
Cost of ingredients	Rs	6600/-
Fuel /electricity /water	Rs	1200/-
Packaging material	Rs	3000/-
Wages	Rs	2000/-
Interest on investment (10% share)	Rs	1256/-
Marketing and Sales promotion @ 30%	Rs	7580/-
Total cost	Rs	32836/-
Cost/Kg	Rs	253/-
Selling Price/Kg	Rs	304/-
Revenue (304 x 130)	Rs	39520/-
Profit/day	Rs	6684/-
Profit (300days x 6684)	Rs	2005200/-
C. Fish cutlet (170kg/day)		
Raw material cost (cooked fish meat 100 kg)	Rs	8000/-
Cost of ingredients	Rs	1000/-
Cost of batter & breadcrumbs	Rs.	1000/-

Fuel /electricity /water	Rs	1000/-
Packaging material	Rs	2500/-
Wages	Rs	2000/-
Interest on investment (25% share)	Rs	3140/-
Marketing and Sales promotion @ 30%	Rs	5600/-
Total cost	Rs	24240/-
Cost/Kg	Rs	143/-
Selling Price/Kg	Rs	172/-
Revenue (172 x 170)	Rs	29240/-
Profit/day	Rs	5000/-
Profit (300 days x 5000)	Rs	1500000/-
D. Fish Wafers (175 kg/day)		
Raw material cost (cooked fish meat 100 kg)	Rs	8000/-
Cost of ingredients	Rs	2225/-
Fuel /electricity /water	Rs	1000/-
Packaging material	Rs	1000/-
Wages	Rs	2000/-
Interest on investment (20% share)	Rs	2512/-
Marketing and Sales promotion @ 30%	Rs	5000/-
Total cost	Rs	21737/-
Cost/Kg	Rs	124/-
Selling Price/Kg	Rs	149/-
Revenue (149 x 175)	Rs	26075/-
Profit/day	Rs	4338/-
Profit (300 days x 4338)	Rs	1301400/-
E. Dressed Fish Steaks (150kg/day)		
Raw material cost (Whole fish 250 Kg)	Rs	10000/-
Fuel /electricity /water	Rs	2000/-
Packaging material	Rs	1500/-
Wages	Rs	2000/-
Interest on investment (20% share)	Rs	2512/-
Marketing and Sales promotion @ 30%	Rs	4800/-
Total cost	Rs	20812/-
Cost/Kg	Rs	139/-

Selling Price/Kg	Rs	167/-
Revenue (167 x 150)	Rs	25050/-
Profit/day	Rs	4238/-
Profit (300days x 4238)	Rs	1271400/-

* The figures mentioned are based on assumptions regarding the raw material & ingredient costs, wages, and other charges and are only indicative. The actuals will vary from location to location.

9.0 Implementation of HACCP

HACCP stands for Hazard Analysis Critical Control Point. HACCP is a systematic approach to the identification, evaluation, and control of food safety hazards. It is a proactive strategy where hazards are identified and assessed, and control measures are developed to prevent, reduce, or eliminate a hazard.

There are seven fundamental HACCP principles, viz :

Principle 1 — Conduct a hazard analysis.

Principle 2 — Determine the critical control points.

Principle 3 — Establish critical limits.

Principle 4 — Establish monitoring procedures.

Principle 5 — Establish corrective actions.

Principle 6 — Establish record-keeping and documentation procedures.

Principle 7 — Establish verification procedures.

Before implementing HACCP, Prerequisite programs, (GMP, Good Manufacturing Practices and SSOP, Standard Sanitary Operation Procedure) have to be in place. The minimum allowable sanitary conditions for the equipment and facilities are identified as Sanitation Standard Operating Procedures. SSOPs consist of written cleaning and sanitizing procedures, validation procedures, and records regarding sanitary conditions both pre-processing and during processing. The SSOP verifications are to be regularly performed on a daily basis. This prerequisite program requires that employees be trained in food safety practices and that wholesome fishery products are produced under sanitary conditions.

The products which are to be manufactured have to be described in details with its distribution chain. This provides information on the ingredients, processing methods, and distribution methods (frozen, refrigerated, or at ambient temperature). The intended use and consumers of the food also has to be described thoroughly. These may be the general public or a segment of the population such as infants, elderly, military, hospital patients, etc. This is followed by developing a flow diagram describing the process for each product— This diagram provides a clear, simple outline of the steps involved in the making the product. A block flow diagram is usually sufficient. Verify the flow diagram — The HACCP team should perform an on-site review of the operation to verify the accuracy and completeness of the flow diagram. Perform a walk-through of the process to make sure all process steps are covered. Once those preliminary tasks are completed, the processor can develop the actual HACCP plan by taking the following steps.

Conduct a hazard analysis —the HACCP team reviews the ingredients used, activities at each processing step, and then makes a list of food safety hazards that are reasonably likely to cause injury or illness if not controlled. These food safety hazards may already be present in the raw material or, on the other hand, these may be introduced during the subsequent processing stages, which thus adversely affect the hygiene and safety status of the product. The implementation of hygiene and safety measures is to ensure that contamination and cross-contamination are prevented at every stage of the food chain. Contamination means the presence or the bringing in of these hazards into the food. Cross contamination occurs when these hazards, especially, pathogens are transferred from one food or surface to other items, such as hands, utensils or other foods. The aim of hygiene measures is to prevent cases of such contamination. It should be clearly understood that food hygiene and safety measures are dynamic that are not completed at a particular point in time, but requires renewed attention daily. Hygiene measures must be understood as preventive measures. Continuous monitoring of each individual step in the process should ensure faultless foods. An end control of the product cannot replace continuous monitoring.

Next, each hazard is evaluated and its likelihood of occurrence is determined. The hazards are categorized as chemical, physical, and biological.

Supporting documentation is needed to justify all decisions about whether or not something is a hazard. For example, a physical hazard of metal shavings from grinding may not be a hazard likely to occur if your maintenance program (and its records) documents that periodic checks of the grinder are performed and worn parts are replaced.

Determine critical control points (CCPs) — this identifies a step in the process at which control must be applied to prevent, eliminate, or reduce to an acceptable level a food safety hazard. Examples of CCPs may include cooking times and temperatures, chilling times and temperatures, or pH control. Necessary source control should be prepared for preventing chemical hazards like pesticides, antibiotics, heavy metals, hormones etc. For each CCP, critical limits has to be identified, which provides a maximum or minimum value to which the biological, chemical, or physical hazard must be controlled at a CCP to prevent, eliminate, or reduce to an acceptable level the occurrence of a food safety hazard. The critical limit distinguishes between safe and unsafe operating conditions at a CCP. Each control measure has one or more critical limit, which can either be quantitative or qualitative, and they must be scientifically based. For example, if a cooking step is selected as a CCP for controlling bacterial growth, a certain time and rate would be specified. Adequate monitoring procedures should be established, which are a planned sequence of observations or measurements (e.g. collection of data) to assess whether a CCP is under control, and to produce an accurate record for future use in verification. Monitoring facilitates tracking of an operation, shows if there is a loss of control at a CCP, and provides written documentation for use in verification. Monitoring is a real time activity, which clearly states, what has to be monitored? how it has to be monitored? the frequency of monitoring and who is responsible for monitoring. Establishing corrective actions is the next logical step, which specifies what is done when a deviation occurs: Who is responsible for implementing the corrective actions? What happens to the product? What caused the deviation? How can it be prevented from reoccurring? Producers must generate a record documenting these decisions.

Establish verification procedures — Verification consists of those activities that determine the validity of the HACCP plan and show that the system is operating according to the plan. Part of verification is validation. Validation

is the scientific information, in-plant data, or expert opinions documenting that the existing process(es) — and their respective critical control points, critical limits, and monitoring procedures — produce a safe food product. A validation example might be the documentation used to select a cook step to control salmonella in a ready-to-eat product, the minimum time and temperature needed to cook the product, and the frequency of temperature monitoring to ensure safety. The second part of verification is to "verify" that the validated plan is being followed correctly. Examples of "verifying" include: calibration of process monitoring instruments, direct observation of monitoring activities and corrective actions, and review of records generated and maintained in accordance HACCP Plan.

Acceptance and implementation of Food Safety programmes like HACCP should be in place from farmer to consumer. The Codex Alimentarius Commission – an organization linked to the WHO (World Health Organization) and FAO (Food and Agriculture Organization of the United Nations), with representatives from more than 180 countries – has published the HACCP (Hazard Analysis Critical Control Point) approach for managing food safety risks. This approach is being adopted by government agencies and industry organizations globally. Although specific regulations in different parts of the world continue to evolve, they typically feature some common elements from HACCP:

- HACCP is a systematic approach covering all aspects of food safety from raw materials, growth, harvesting and purchase to final product use.
- Use of HACCP will move a company from sole retrospective end product testing approach towards a preventive quality assurance approach.
- HACCP provides for a cost-effective control of food borne hazards
- Use of HACCP focuses technical resources into critical parts of seafood processing.
- The use of preventive approaches such as HACCP leads to reduced product losses.

HACCP was designed to prevent hazardous products from leaving the manufacturing or processing facility. The key to the success of HACCP is personnel training, behavior and attitude, be it a farmer, processor, retailer or consumer Although HACCP provides insurance that food is safe, there is no way to completely eliminate all hazards. HACCP is most effective when used with other control systems. Total Quality Management programs and Standard Operating Procedures should be used along with HACCP to improve product safety, product quality, and plant productivity by providing intimate knowledge of the production process, production environment and processing equipment. Establishing HACCP plan will be an ideal platform for a fish processing unit to comply with FSSAI regulations.

9.0 Capacity of the Mini Fish Processing Unit

The Mini Fish Processing Unit can be utilized to process 150Kg of wet fish/shrimp (based on the ice production capacity of 300kg per day). The Mini Fish Processing Unit is also equipped to process 50 Kg of dried fish (based on the capacity of the solar dryer). The total production capacity of the Mini Fish processing Unit is about 200 Kg per day.

Conclusion:

Establishing, managing and maintaining the mini fish processing unit would benefit the fishers and small scale entrepreneurs in realizing better price for the fish and at the same time encourages fish consumption by the public by making available different value added fish products. It can also function as a training-cum demonstration centre and develop entrepreneurial skills of interested fishers, self-help group members and small scale entrepreneurs. This report contains the salient features of a processing plant with the product profile and main unit operations involved. The cost estimates are general in nature and the cost components are highly variable which will depend on the location of the unit.

Annexure 1.

List of equipment suppliers for Mini Fish Processing Unit*

[* The list (not a complete list) is given to help the user to make preliminary enquiries regarding the availability and price estimate for the equipments. However, the user is advised to make a thorough market survey for price and models available from other suppliers before arriving at a purchase decision].

1.	**Flake ice machine**	1. J.L.Technologies, No, 7-147/3, i1st Floor, Street No. 1, Nagendra Nagar Colony, Habsiguda, Hyderabad-500007 2. Spectrum Associates, 202, Deepak Plaza, D.C. Chowk, Sector 9, Rohini, Delhi-110085; Ph: 47037353 3. Spectrum Associates, No. 29 Adigiri First Cross MICO Layout, Mahalaxmi-puram, Bangalore 560 086, Tel Fax : 80-23490523 4. Bio Instruments, No. 87, 2nd Main, 3rd Cross, Bikasipura, Bangalore - 560 061 5. Frostec Solutions, #21/2, Navaneeda ammal street, Ayyavoo colony, Aminji-karai, Chennai - 600029. 044-23633276 6. OM Refrigeration Industries, Laxmi Nivas, 43/1/1A, Dattanagar, Near Aroha Mangal Karyalaya, Ambegaon, Pune-411046; 020-24318369 7. Frick India Limited, Tieckon House, 3rd Floor, Dr. E. Moses Road, Mumbai - 400011, Maharashtra, India Phone : 91-22-24925203/24924687 Fax : 91-22-24935552 8. Crown Refrigeration Industries, Plot No. 97-A, Lane No. 9, Anand, New Delhi, 110 005, India www.crownrefrigeration.com

		9. Premier Refrigeration & Air Conditioning Pvt. Ltd., Hammersmith Industrial Estate, Narayan Peth Marg, Off Sitladevi Temple Road, Mahim, Mumbai, 400016, India.
2.	**Iceboxes and plastic crates**	1. Sintex Industries Limited, Plastic Division, Kalol (N. Gujarat) 382 721. Phone: +91-2764-253500 http://www.sintex-plastics.com 2. Nilkamal House, Street No. 14, M.I.D.C., Andheri (East), Mumbai-400093, 022-2681 8591 3. Nilkamal, Madhava Nursing Home, SD Road, msri Classic Complex, Unit No. 3, 4th Floor, Secundrabad - 500003, 040-27700068 secundrabad.ro@nilkamal.com 4. Saeplast India Pvt Ltd., A-71, Corporate House, Judges Bunglow Rd., S.G. Highway, Bodakdev, Ahmedabad - 380054 079-26841087, 26841089.
3.	**Processing equipments** (meat mincer, deboner, hand operated meat mincer, hand operated noodles machine, SS tables, heat sealers, thermostat controlled electric fryers, etc.)	1. M/s Sun Labz Equipments, New No.14, First Floor, West Sivan, Koil Street, Vadapalani, Chennai - 600026, Ph: / Fax No.: +91-44-23652288, Email: sunlabz@yahoo.com 2. Advanced Laboratory Systems AP-54, 1st Sector, 5th Street, K.K. Nagar, Chennai - 600 078 Mob: 9841022118 Fax: 044-43530583 3. Spinco Special Instruments (p) ltd PB.2927 Block G.5 & G.8, No.197 Luz church road, Mylapore Chennai - 600004

		4. Beetta Instruments & Equipments Co. No.74, Thiruvattuvar Street, Jagathambigal Nagar, Padi Chennai- 600050 5. Elixir Technologies 29 Ground floor, 1st Cross Mico Lay-out, Mahalakshmipuram Bangalore - 560086 6. Global Technologies 635 B, 3rd floor, E Block, 2nd stage, Dr. Rajkumar Road Rajajinagar, Bangalore - 10 7. Hemetek Techno Instruments Pvt. Ltd. 503 & 95, Acome Industrial Park Western Express Higway, Near Aarey Flyover Goregaon (East), Mumbai - 400063 8. Bombay Gas Light Stores, 10-1-27/A, Asilmetta Junction, Visakhapatnam - 530 003 0891-2755193, 9866122921 9. SraUdyog No.C.167, Sector-10 NOIDA-201301 UP 10. Laxmi Sales Company (LSC INDIA) 159/15, Omkar Nagar-8 Tri Nagar, Delhi-110035 11. Kantam International No.13, B.B. Ganguly street 1st floor, Room-103, Punarnava Kolkata -700012 12. Rajkumar Agro Engineers Pvt. Ltd. Near Union Bank of India, Ghat road Nagapur - 440018, Maharashtra 13. Agaram Industries No.73m Nilson Road, Amaindhakarai Chennai - 600029

		14. Bharat Machine Tools Industries 61, Ganesh Chandra Avenue Kolkata 700013
4.	**Weighing scales**	1. Essae Teraoka Ltd, 50-102-3, 1st Floor, TPT Colony, N.E. Layout, Seethammadhara, Visakhapatnam-530013; 9393699200 2. Afcoset Balances, 6-1-69/6, S.R. Apartments, Saifabad
5.	**Table top vacuum packaging machine**	1. Sevana Electrical Appliances Pvt. Ltd., PB#2, Kizhakkambalam P.O., Kochi-683562, Phone : +91- 484 - 2680780 Email : mail@sevana.com 2. Beetta Instruments & Equipments Co. No.74, Thiruvattuvar Street, Jagathambigal Nagar, Padi, Chennai - 600050 3. Elixir Technologies, 29 Ground floor, 1st CrossMico Lay-out, Mahalakshmipuram Bangalore - 560086 4. Sealers India Agencies, AI-1`18, D.No. 19.8, Main Road, Anna nagar, Near Shantihi colony, Chennai - 600040 5. Advanced Laboratory Systems AP-54, 1st Sector, 5th Street, K.K.Nagar, Chennai-600 078, Mob: 9841022118 6. Hemetek Techno Instruments Pvt. Ltd., 503 & 95, Acome Industrial Park, Western Express Higway, Near Aarey Flyover Goregaon (East), Mumbai - 400063

		7. Advanced Laboratory, Gala No.17, Jaimataji Society, Perubauge Compound, Asalpha Link Road, Ghatkopar (West), Mumbai 400 084 8. Avanti Business machines Pvt Ltd, 1-10-72/5/1A, Cheekoti Gardens, Begumpet, Hyderabad-500016. 9. Mahavir Enterprises, 40/7705, Chittoor Road, Pullepady Jn, Kochi-682 035. 10. Neelam Industries, Plot No. 25, Govt. Industrial Estate, Kandivili (W), Mumbai - 400067 11. IshanInternationl Pvt Ltd., b-68, Sector-14, Noida-201301 12. A.J. Engineers, M-3, Radhesh Apartments, Drive-in-road, Ahmedabad-380054. 13. Associated Engineering Corporation, 298, Industrial area, Opp. Mall Mandi, Chamrang Road, Amritsar - 143006. 14. Dolphin Laminates, 17A, Monarch Manor, 90 ft road, Safed pool, Mumbai - 400072.
6.	**Deep freezer**	1. Celftrost Innovations Pvt. Ltd., 3rd Floor, SLV House, Plot No. 14, Sector 44, Near Hotel TajVivanta, Institutional Area, Gurgaon-112003; Ph: 124-4308430 2. Blue Star, D. No. 49-24-65/1, ResapuvaniPalem Village, Madhura Nagar Mandal, Near Sankarmattam Road, Visakhapatnam 530 016 , Tel: 0891- 274 8405

		3. Genesis Bio Solutions, 102, Satguru Apartments Extn, 12-13-99, Street No.3, Lane No.1, Tarnaka, Secunderabad - 500 017 4. Middleby Commercial Food Innovations Pvt. Ltd., 2nd Floor, 4B, Lansdown Lane, Near to Beltola Girls High School, Bhawanipore, Kolkatta - 700 026 5. Presto Stantest Pvt. Ltd., 1-42, A.D.L.F. Industrial Area Phase-1, New Delhi - 110034 6. Biomate India Pvt. Ltd., 436, Shahabad Daulatpur, Near sec-17, Rohini, New Delhi-110042 7. Sigma Scientific Instruments Pvt. Ltd., No.9/5, Achutan Nagar, 2nd Street, Ekkattungal, Chennai - 600032 8. Techlab Instruments Co, 20, 4th Street Thiruvalluvar Nagar, Kotturpuram, Chennai - 600085 9. Inlab Equipments (Madras) Pvt. Ltd., 23 MG Road, Chennai - 600020 10. Calgon scientific Co., 50/720T, Vinayaka, LBS Road, Ponekkara, Edappally, AIMS (PO), Kochi - 41 11. Arotic Cooling Systems, G.405, Panampilly Nagar, Kochi-36 12. Niulab Equipment Company Pvt. Ltd., 27/3151 E Second floor, KMJ Apartment, opp Passport Office, Panampilly Nagar, Kochi-36 13. Cochin Lab Equipments India Pvt. Ltd., Kalappurakkal Towers, Netaji Road, Kadavanthara, Kochi - 682020

		14. BIO Equip Inc., C. 008, Premier, Grihalakshmi Apartments, 13/2, S M Road, Jalahalli West Bangalore - 560015
7.	**Digital food probe thermometer**	Any Laboratory equipment dealers
8.	**De-scaling machine**	Ephraim Engineering Agencies Nellissery House, Coraya Road, Pachalamp.O., COCHIN-682 012 KERALA
9.	**Fish dryer (solar)**	Kraftworks Solar Pvt. Ltd., Adithya, 29/2862, Near Gandhi Square, Poonithura, Kochi - 682 038 0484-2707339; 0484-270228
10.	**Packaging material** (LDPE, PP, Polythene, polyester/polythene laminates, LH/HD co extruded film, PEST/PE)	1. Mahavir Enterprises, 40/7705, Chittoor Road, PullepadyJn, Kochi - 682 035. 2. Ceylon Fancy Stores, Market Road, Ernakulam 3. Blue Max Co., Market Road Ernakulam. 4. Premier Plass Pack Ltd., 231, Pollachi Road, Kurichi, Coimbatore-641021. 5. Pushpa Packaging Ltd. 55/2, Yellapura village, Doddaballapur - 561203, Bangalore 6. Yogflexpack, Nallore, Pannamvel, Pattanakad P.O., Chertla, Alleppey 0478-2545512 7. Trends Polymer Pvt. Ltd., Kakinad, P.O., Vadavucode, Puthencruz, Kochi - 682 310 8. Glory Polyfilms Pvt Ltd., 4th Floor, Abhyankar Towers, MG Road, Nasik, 422001

		9. Flexo Film Wraps 9India) Ltd, 44-B, GST Road, Guindy, Chennai-600032. 10. M.H.Packaging, Navdeep House, 3rd Ashram Road, Ahmedabad-380014. 11. Paper products Ltd., Vaswani Mansion, Dinsha Waccha Road, Mumbai-400020 12. Vikas Laminates Ltd., Chateau 'D" Ampa, 4th Floor, 110, Nelson Manickem Road, Aminjikarai, Chennai - 600029. 13. Essel Packaging Ltd., Continental Buildings, 135, Dr. A.B. Road, Worli, Mumbai - 400018.

REQUIREMENTS FOR A MINI FISH PROCESSING UNIT

(for small scale entrepreneurs, self-help groups and co-operatives)

ICAR - CIFT Technology Advisory Series - 16

Fish processing and value addition has evolved over the years as the sunrise sector in Indian Agriculture. Fish and fishery products earn maximum foreign exchange in the category of agricultural produce exported from India. This sector has immense scope for development through diversification and generation of employment for the skilled and unskilled workforce of the country. A mini fish processing unit is intended for the benefit of fishers and small scale entrepreneurs. It can be utilized for production of value added products such as fish fillets, fish steaks, fish pickles, fish wafers, fish cutlets, fish balls, fish noodles, fish fingers, dried fish etc. The facility can be used as a training and demonstration centre also. This technical publication gives an account of the requirements for the unit, a model layout, product profiles and process flow, production costs and profitability index, HACCP guidelines, general list of equipment and probable source of suppliers in India.

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2015