PM Formalisation of
Micro food processing Enterprises Scheme

Handbook on

FOOD DOMAIN

KNOWLEDGE BASE

Food Processing EDP Training for Credit Linked Subsidy Beneficiaries Under PMFME Scheme

Training Handbook on

Module 7: Food Domain – Knowledge Base

Contributors

Dr. Abhijeet Arun Gatade
Ms. V. Nandhini
Mr. Vijay Kumar
Ms. Priya Aggarwal
Dr. V. R. Sinija

Acknowledgement

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Chapter I
Introduction to Domains of Food Industry

1.1 Domains of Food Industry

A domain is an activity of food processing industry, especially one over which someone has control and which influence the quality of finished products. It covers the wide range of activities, starting from harvesting, preparation, intermediate processes and final processes These domains have certain attributes; and observations for measuring the attributes.

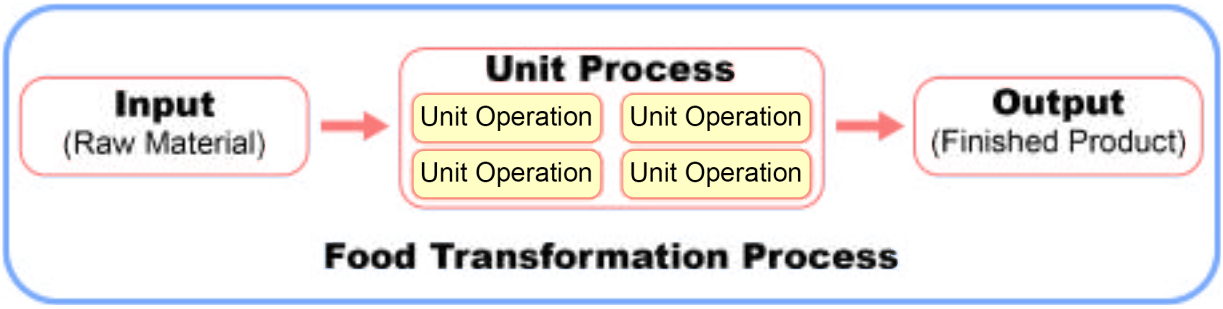
In this module we will be discussing about domains associated with operational activities for food transformation process. The food transformation process involves two main activities. (i.e. a Unit Process or a Unit Operation)

Unit Process:

The unit process is referred as chemical and physical change leading towards transformation of raw material into finished products. A control over unit process can be made through different process parameters, like process temperature, process time and process pressure, the extent of chemical changes, yield of finished product etc.

Unit Operation:

The unit operations mainly referred as physical changes in the raw materials handled or during the conduct of process under consideration. In other words, unit process involves a correct sequence of unit operations (i.e. Domains of Food Processing).



Example:

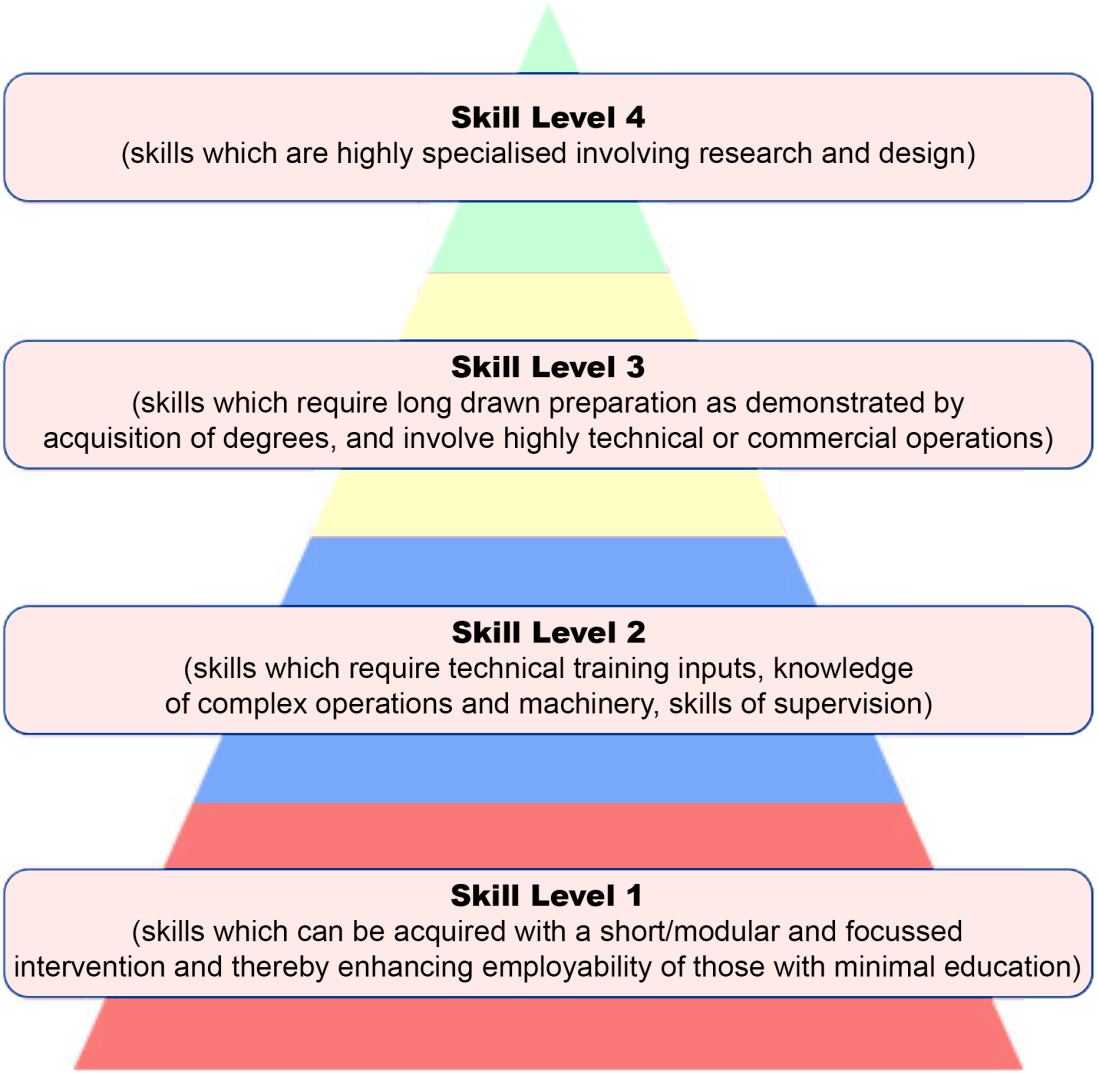
A process of converting raw milk (Raw Material) into packaged pasteurised milk (Finished Product) involves various unit operations in a correct sequence like; filtration, homogenization, pasteurization, packaging etc.

1.2 Need of Food Domain Knowledge

Technology and advancements in food processing has helped in transforming Indian Food Processing Industry considerably. But, the technology used in Indian Food Processing Industries are not up-to-date with international trends in all sectors. It is being considered as a significant risk factor for the industry across segments. Along with this there is a huge demand for skilled workers at all the stages in food processing industry, as reported by NSDC. It is being observed that, the demand for skilled and technically sound manpower is continuously increasing. This demand is reported greater in unorganized sector rather than organized sector of food processing.

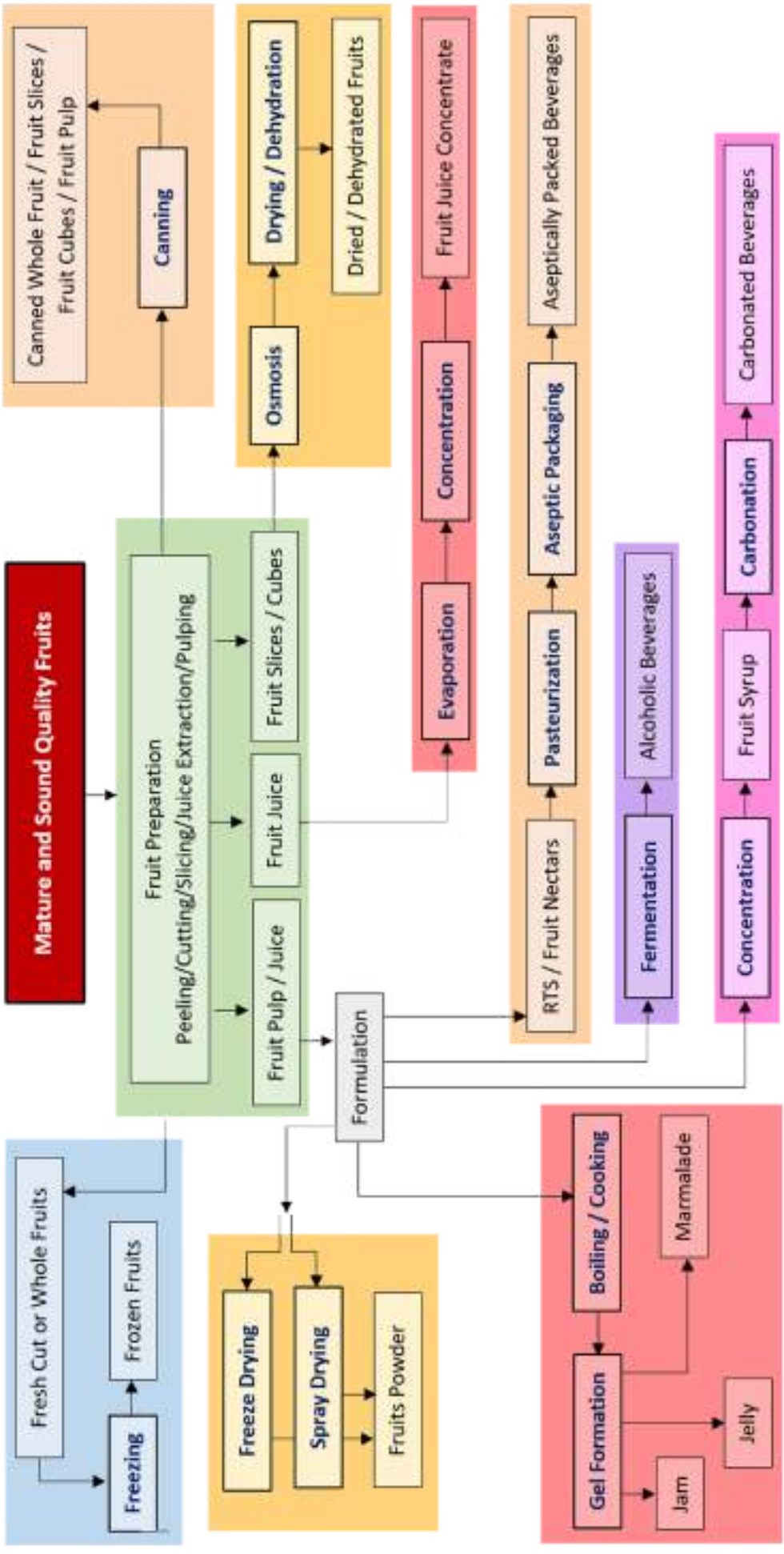
The Skill Pyramid Given below reflects the Skills at a particular level of job role. It has been reported that large proportion (i.e. about 80%) of human resources in food processing industry falls under Skill Level 1 and only 2% of food professionals are with Skill Level 4.

It is therefore very much necessary to fill the skill gap in food processing industry, by imparting domain based knowledge to the human resources of unorganized food processing sectors. NIFTEM-Thanjavur and NIFTEM-Kundli are autonomous bodies striving for development of human resource in food processing sector. In this module, different concepts and practices in domains of food transformation process are elaborated with suitable process flow charts to cover diverse skill needed in Micro Food Processing Enterprises.



1.3 Summarized Flow Chart for different domains of Fruit Processing

The flow chart given below represents various unit operations of different fruit product lines. The unit operations like Fruit Preparation, Canning, Freezing, Freeze Drying, Spray Drying, Osmosis, Drying, Dehydration, Evaporation, Concentration, Boiling, Gel Formation, Carbonation, Fermentation, Pasteurization, Aseptic Packaging etc. are described in brief for acquiring the fruit processing domain knowledge.


Mature and Sound Quality Fruits
Fruit Preparation
Peeling/Cutting/Slicing/Juice Extraction/Pulping
Fruit Slices / Cubes
Fruit Juice
Fruit Pulp / Juice
Canning
Canned Whole Fruit / Fruit Slices / Fruit Cubes / Fruit Pulp
Drying / Dehydration
Osmosis
Dried / Dehydrated Fruits
Evaporation
Concentration
Fruit Juice Concentrate
Pasteurization
Aseptic Packaging
Aseptically Packed Beverages
RTS / Fruit Nectars
Fermentation
Alcoholic Beverages
Concentration
Fruit Syrup
Carbonation
Carbonated Beverages
Formulation
Fresh Cut or Whole Fruits
Freezing
Frozen Fruits
Freeze Drying
Spray Drying
Fruits Powder
Boiling / Cooking
Gel Formation
Marmalade
Jam
Jelly

1.4 Unit Operations in Fruit Processing Industry

Fruit Preparation

The method used to convert the fruit into more usable form for processing and to obtain edible portion from fruits is called as fruit preparation. It can be achieved by following methods.

Peeling

Peeling of fruit is one primary unit operation in which outer peel of fruit is removed, which may interfere with process and finished product quality. It can be done mechanically by using knives, blades, and abrasive devices or chemically by using lye treatment also.

Cutting

A method of dividing the whole fruit into small fraction before its intended use. Cutting of fruits can be done manually by using knife or mechanically by using fruit cutter.

Slicing

Slicing is a form of size reduction. It converts the fruit into uniform size and shape portion without changing the chemical properties. It is a cutting of fruit into thin pieces, and makes the fruit more suitable for operations like canning, drying, etc.

Juice Extraction

Squeezing of liquid juicy part from fruit from solid-fibrous matrix of fruit by means of mechanical way is called juice extraction. It can be achieved by use of juice expellers, hydraulic juice press, roller pressing, fruit squeezer, juicer etc. The extraction should be in such a way that the extracted liquid portion represents aesthetic properties of fruit with specified fruit solids.

Pulping

Pulping is process of crushing the fruit and/or separating the edible pulp from seed and skin of fruits. Industrially pulping it carried out by using fruit pulper, fruit crusher or fruit mill.

Canning

Canning is a method of fruit preservation in which fruit (either whole/cut pieces/slices/pulp) is processed and sealed in an airtight container like tin can and glass jars. When canning fruits in whole or cut or sliced form the void space has to be filled with sugar syrup of required sugar strength.

Freezing

Freezing is one of the fundamental methods for long-term preservation and storage of fruits. In this, the water in the fruit freezes into ice making it unavailable for chemical and microbiological actions, thus preserving the fruit from spoilage. Thermal centre of fruit should reach to a temperature of -18°C.

Osmosis

It is a partial removal of water from fruit tissues by immersing the fruit in a hypertonic osmotic solution (i.e. sugar syrup). The concentrated sugar syrup solution makes the water gets dragged out from the fruit cell membrane till an osmotic equilibrium is attained. The fruits are then dried for removing the excess surface water.

Drying and Dehydration

Drying is a method of removing the moisture form fruit, by means of thermal energy. Whereas dehydration is complete removal of bare minimum water under controlled conditions of Temperature, Pressure, Air Velocity. In both the cases, at elevated temperature the water from fruit slices/cubes gets evaporated.

Spray Drying

It is more suitable for converting fruit juice/pulp in fruit powder. In this process fruit juice/pulp is mixed with additives (i.e. drying aids) and converted into fine mist and supplied/delivered into a drying chamber by atomization. The water from the fine droplets gets evaporated leaving behind the fruit solid particles in powder form.

Freeze Drying

The moisture from frozen fruit/pulp/juice is removed by sublimation, where the ice is directly converted into water vapour. As the process is carried out at cold condition, it minimizes quality loss associated with high temperature drying process.

Evaporation

In evaporation, the water from fruit juice/pulp is removed by boiling it. The evaporation can be carried out by using methods like; an Open Vat Evaporation (at about 100°C) or by Vacuum Evaporation (at about 60°C).

Concentration

Juice concentration is carried out by evaporation of water from juice which increase the soluble solids (Brix) content. The increase in solid concentration of juice improves its keeping quality and thus preserves it.

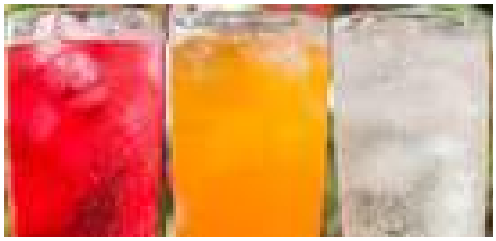
Boiling or Cooking

Boiling or Cooking of Fruit pulp/juice is one of the most important steps in the making fruit preserves like Jam, Jelly and Marmalade. It dissolves the added sugar and the combined action of dissolved sugar, acid and pectin forms gel like structure. The boiling/cooking helps to remove water and increases the sugar concentration, and hence attaining the desired quality attributes in the product.

Gel Formation

The combined action of sugar, acid and pectin (either naturally present in fruit or externally added) during cooking, which results in gel network, a form of matter intermediate between a solid and a liquid.

Carbonation



Carbonation is, addition of carbon dioxide gas to a beverage under high pressure. This imparts sparkle and a tangy taste to the beverage; and also prevents spoilage. For this a Carbonation Unit is required.

Fermentation

Fermentation is the controlled operation where, beneficial microorganisms (especially yeast) utilizes the oxygen and consume sugar from the fruit juice, and produces fruit alcohol (specific concentration) and allied flavour components. Fruit wine is an example of alcoholic beverage.

Pasteurization

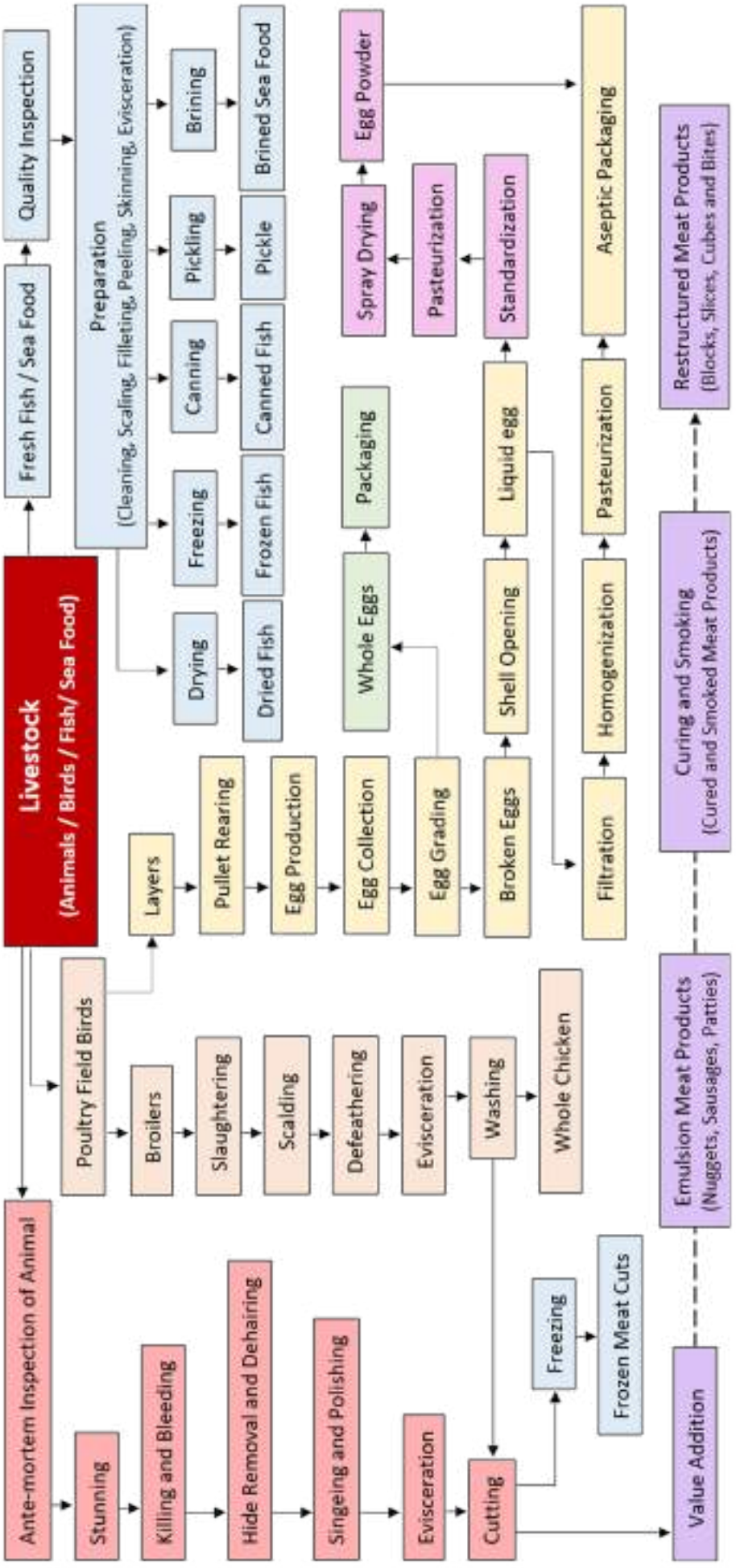
It is a thermal treatment at a temperature lower than boiling point of water. It destructs the pathogenic micro-organisms and also inactivates the deteriorative enzymes, thus extending the shelf life of product. Pasteurization of fruit juice/ fruit nectars fruit beverages is carried out at 85°C for 15-40 minutes depending on the size of the packaging container.

Aseptic Packaging

It is the process of filling and sealing of sterile product in sterile packaging material under aseptic environmental conditions. Fruit juices packed in multilayer pack are the best example aseptically packed beverages.

1.5 Summarized Flow Chart for different domains of Animal Based Products Processing

Animal based processing includes Slaughter House, Poultry and Fish Processing Unit. The products are rich source of animal protein and other nutrients. Being highly perishable in nature, care has to be taken while handling and processing of these products. It is therefore necessary for any personnel working in animal product processing industry to have a basic knowledge of processing steps and operations in order to maintain hygiene and safety. The flow chart given below represents various unit operations of different animal based products processing lines.


Livestock
(Animals / Birds / Fish/ Sea Food)
Fresh Fish / Sea Food
Quality Inspection
Preparation
(Cleaning, Scaling, Filleting, Peeling, Skinning, Evisceration)
Drying
Freezing
Canning
Pickling
Brining
Dried Fish
Frozen Fish
Canned Fish
Pickle
Brined Sea Food
Poultry Field Birds
Layers
Pullet Rearing
Egg Production
Egg Collection
Egg Grading
Whole Eggs
Packaging
Spray Drying
Egg Powder
Broilers
Broken Eggs
Shell Opening
Liquid egg
Pasteurization
Standardization
Slaughtering
Scalding
Defeathering
Evisceration
Washing
Whole Chicken
Filtration
Homogenization
Pasteurization
Aseptic Packaging
Ante-mortem Inspection of Animal
Stunning
Killing and Bleeding
Hide Removal and Dehairing
Singeing and Polishing
Evisceration
Cutting
Freezing
Frozen Meat Cuts
Value Addition
Emulsion Meat Products
(Nuggets, Sausages, Patties)
Curing and Smoking
(Cured and Smoked Meat Products)
Restructured Meat Products
(Blocks, Slices, Cubes and Bites)

1.6 Unit Operations in Animal Based Products Processing Industry

Ante-mortem Inspection

The procedure followed for evaluating the quality of animal for the purpose of rearing, processing and transforming them into form fit for human consumption. It includes, detection of any sign of disease, distress, injury etc. for the safeguard of consumers.

Stunning

The stunning process is carried out to ensure the animal is unconscious and insensible to pain before slaughtering. Promotes animal welfare & impacts positively on meat quality. Stunning of animal is carried out by mechanical, chemical or electrical methods.

Killing and Bleeding

Killing of slaughter animals is usually done by bleeding. Bleeding is performed by severing at least one jugular vein and carotid artery in order to have rapid blood loss, which impacts on meat quality.

Hide Removal and Dehairing

Hide is nothing but the skin of animal which is used for leather making. Before removing the hide (skin) dehairing of animal is necessary to remove hair, mud, manure, and other external contaminants.

Singeing and Polishing

To burn loose hairs, the remaining hairs and bristles using flame for surface sterilization, cleaning and to get uniform and neat appearance.

Evisceration

Evisceration is a process of removing the viscera, internal organs and inedible portion from carcasses or slaughtered birds. This helps in avoiding contamination of meat during cutting.

Meat Cutting

It is the process of cutting the carcass or slaughtered bird into a variety of cuts which intended for sale or further meat processing.

Freezing

Freezing is the process of removing heat so that the water in meat is converted into ice. The internal temperature of meat below the freezing point of meat (i.e. below -1.5^{0}C). Frozen meat should be further stored at or below -18^{0}C. Freezing raw meat can help to prevent premature spoiling by making the water unavailable for microbial and biochemical activities.

Meat

A flesh of animal meant for human consumption.

Value Addition

A process of transforming the meat into meat products of convenience to increase demand and marketability.

Emulsion Meat Products

Products prepared by chopping, mincing, finely homogenizing the meat.

Broilers

Poultry birds that are raised for meat production.

Layers

Poultry birds that are raised for commercial egg production.

Slaughtering

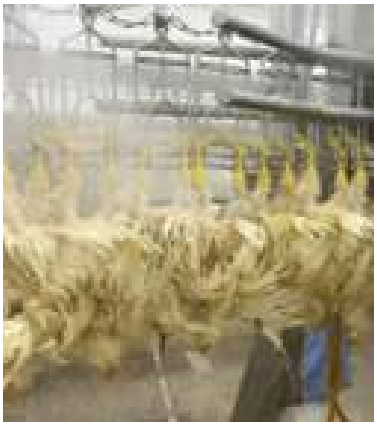
Slaughtering is a process for killing of animals/birds and transforming them into a form meant for human consumption. The slaughtering of birds includes following operations.

Scalding

Scalding is the process of immersing the birds/carcass in hot water to loosen the feather so that they can be easily removed.

Defeathering

Removal of the feathers of poultry birds, by hands or using a machine.


Chicken

A flesh of poultry bird meant for human consumption.

Washing

Washing of carcass or slaughter bird is carried out to remove traces of contaminants especially for reducing the total bacterial contamination.

Curing

A process of preserving meat quality (especially flavour and colour) by using different curing agents like, salt, nitrates and nitrites. Along with this these salts also retards microbial decomposition of meat. Salting (using common table salt) is one the traditional way of preserving meat. The meat is called cured meat.

Smoking

Smoking is the process preserving meat by cooking it through exposing it to smoke from burning or smoldering material, thus enhancing the colour and flavour. Smoking of meat is also one of the method of meat preservation. The meat is thus called smoked meat.

Restructured Meat Products

The consumer-ready product prepared by a process of restructuring the meat, which resembles intact muscle.



Egg Grading

The eggs produced in poultry are graded based on variety of parameters, size, weight, cleanliness, shell condition (i.e. broken or intact). Most commonly intact and whole eggs are meant for retail market, whereas the broken or under quality eggs are used for liquid egg processing.



Shell Opening

The cracked eggs, broken eggs or under grade eggs are opened either manually or mechanically, to take out the internal liquid portion of egg for further processing.

Filtration

A process of removing broken egg shell pieces and other impurities from liquid egg by using filter screen. The liquid egg is also strained some time to separate out yolk from egg white, depending upon the process requirement.

Homogenization

A process of stabilizing the structure of liquid egg prior to pasteurization. The homogenization step facilitates the pasteurization process and render it more effective.

Pasteurization

It is a heat treatment given to the liquid egg, in order to destroy the pathogenic microorganisms especially Salmonella. The pasteurized liquid egg is packed aseptically in suitable packaging material.

Standardization

A process of converting the liquid egg mix to a particular quality standard in order to obtain a specific quality in finished product. The liquid egg is standardized prior to spray drying process to meet process and product consistency.

Spray Drying

A process of converting whole liquid egg, egg white and egg yolk into respective powdered form. The liquid egg is dried using spray drier, where it is first converted into fine droplets and then the water from the droplets is evaporated in drying chamber, thus converting it into powder form. To prevent browning (darkening of colour) of egg powder, the sugar from liquid egg is removed by using commercial enzyme, prior to drying.

Fish and Sea Food Preparation

Prior to processing into retail form or into value added products, the fish and sea foods has to be prepared so as to enhance their marketability and also to facilitate further processing. This preparation stage includes following operations.

Cleaning

A process of removing inedible and unwanted portion

Scaling

A process of removing scale from fish, either manually of by using machines

Filleting

Cutting and slicing out the flesh of fish from bones. The separated flesh is called fish fillet.

Skinning

A process of removing skin from fish flesh.

Peeling

A process to pull out the shell off of the body of shrimp.

Drying

Drying is an oldest method of fish preservation, where water from the fish is evaporated. Traditionally it is carried out by using sun drying technique, where as it can be also done by using various drying equipments.

Freezing

Fish freezing is a process of preservation in which the temperature of fish and fishery products is lowered at -40°C or below with most of the water inside of fish tissue turning into ice. This stops the biochemical reactions and hence extends the shelf life.

Canning

Canning is a thermal treatment of preservation, where fish is packed and sealed in an airtight container like tin can and glass jars, and further thermally processed.

Brining

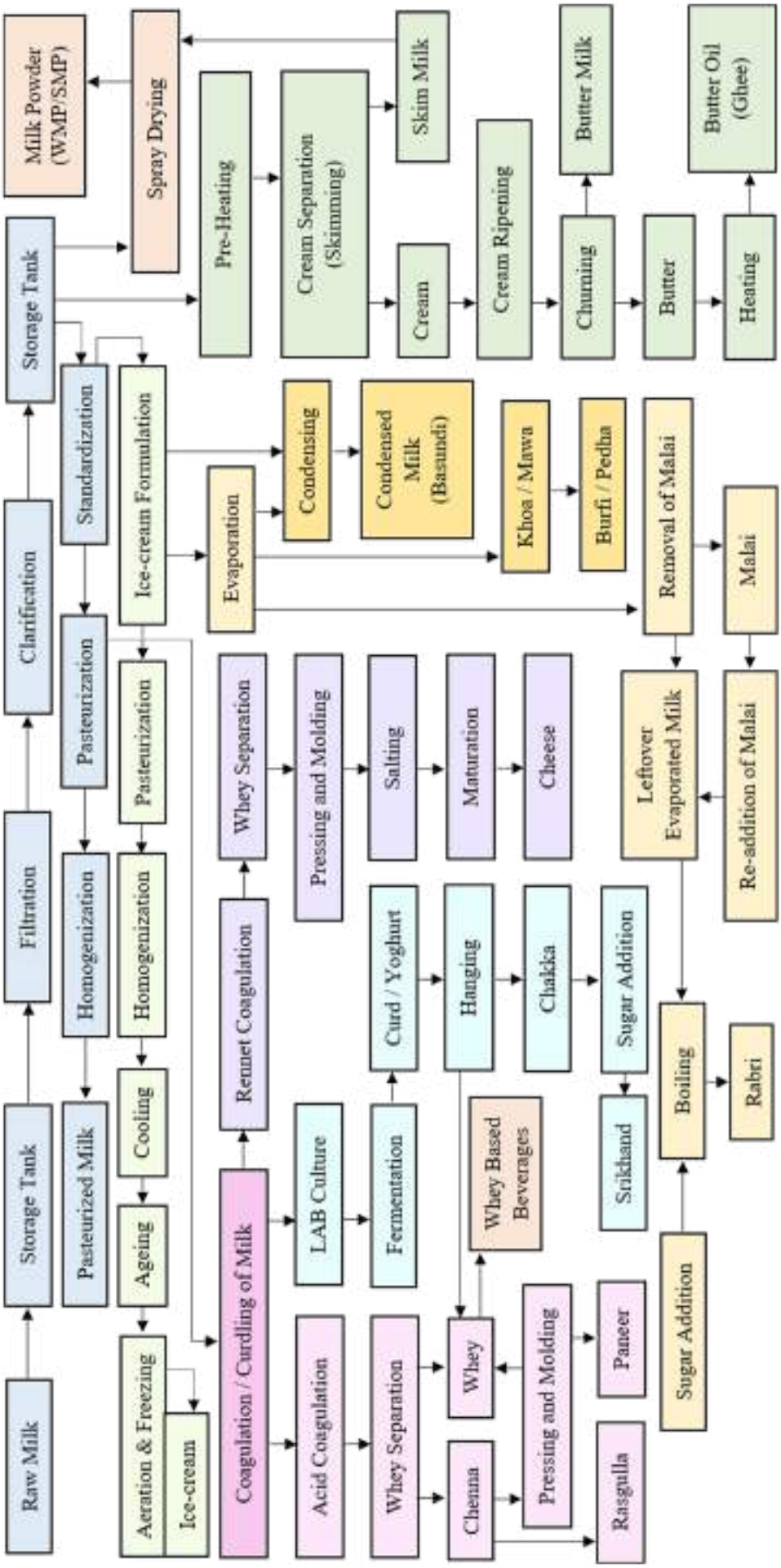
Cleaned fish are submerged under a prepared brine solution for a certain period of time to minimize the possible spoilage and to enhance the storability of fish.

Pickling

A process of curing of fish by addition of salt, acidifying agents, vinegar and/or oil and spice.

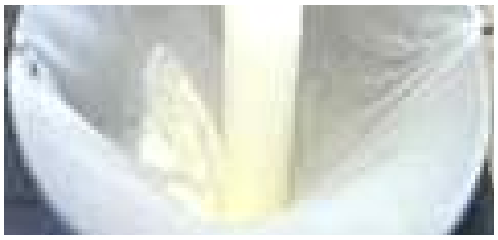
1.7 Summarized flow chart for different domains of Milk Based Product Processing

Milk processing is done to produce milk of low bacterial count, good flavour and sufficient keeping quality. The flow chart given below represents various unit operations of different product lines. The unit operations which includes pasteurization, homogenization, spray drying, condensing, whey separation, fermentation, etc. are described in brief for acquiring the milk processing domain knowledge.


Milk Powder (WMP/SMP)
Spray Drying
Skim Milk
Butter Milk
Butter Oil (Ghee)
Storage Tank
Pre-Heating
Cream Separation (Skimming)
Cream
Cream Ripening
Churning
Butter
Heating
Clarification
Standardization
Ice-cream Formulation
Condensing
Condensed Milk (Basundi)
Evaporation
Khoa / Mawa
Burfi / Pedha
Removal of Malai
Malai
Filtration
Pasteurization
Pasteurization
Whey Separation
Pressing and Molding
Salting
Maturation
Cheese
Leftover Evaporated Milk
Re-addition of Malai
Homogenization
Homogenization
Rennet Coagulation
Curd / Yoghurt
Hanging
Chakka
Sugar Addition
Boiling
Rabri
Storage Tank
Pasteurized Milk
Cooling
LAB Culture
Fermentation
Whey Based Beverages
Srikhand
Ageing
Aeration & Freezing
Ice-cream
Coagulation / Curdling of Milk
Acid Coagulation
Whey Separation
Whey
Paneer
Sugar Addition
Raw Milk
Channa
Pressing and Molding
Rasgulla

1.8 Unit Operations in Milk Based Products Processing Industry

Filtration



Unwanted particulates are separated from milk. Filtration removes suspended foreign particles like dirt, fly, straw, hair etc. by the straining. It can be achieved by using metal screens or filter cloth.

Clarification

Clarification removes the suspended foreign matters by centrifugal sedimentation. The main objective is to improve the aesthetic quality of milk by removing visible foreign matter which is unsightly and may therefore cause consumer complaints and may also interfere with further processing steps.

Cream Separation

The process of separation of cream from milk is known as de-emulsification which involves the breaking of an emulsion into two separate liquid layers and can be achieved by centrifugation. The high amount of fat in cream, make it less dense and gets separated from top opening of centrifugal cream separator.

Skim Milk

Skim milk is a milk from which almost all the cream and fat has been removed without affecting the quality of milk. It is high in protein content.

Cream

Cream may be defined as that portion of milk which is rich in milk fat or that portion of milk into which fat has been gathered.

Standardization

Standardization of milk refers to the adjustment i.e. raising or lowering of the fat and/ or solids-not-fat percentages of milk to a desired value, so as to conform to the legal or other requirements. Pearson's Square method is followed for standardizing the FAT or SNF level of milk.

Pasteurization

The term pasteurization refers to the process of heating every particle of milk to at least 63°C for 30 minutes or 72°C for 15 seconds (or to any temperature-time combination which is equally efficient) in approved and properly operated equipment viz. batch or continuous pasteurizer. After pasteurization, the milk is immediately cooled to 5°C or below. The milk treated by this is called Pasteurized milk.

Cooling

As soon as milk is received in the plant, it is chilled to 5°C or below and stored cool till used, to prevent deterioration in its bacteriological quality during the interim period.

Homogenization

It refers to the process of forcing the milk / ice-cream mix through a homogenizer with the object of sub-dividing the fat globules. The larger fat globules are converted into fine droplets, so that they will disperse in milk phase evenly and hence cream separation will not occur.

Cooling and Ageing

Ice-cream mix has to be cooled to 4.0°C or below, immediately after pasteurization and homogenization. The temperatures below 4°C retard the growth of bacteria. Ageing refers to holding the ice cream mix for at least 24 hours at 4.0°C or below before freezing. Ageing improves body and texture of ice cream, and facilitates aeration to give required overrun. Ageing is carried out in ageing tank.

Aeration and Freezing

In ice-cream making, the aeration and freezing occurs simultaneously. Aeration is a process of adding air in the ice-cream in order to increase the volume of ice-cream. This added air content in ice-cream (often called overrun) affects the taste, texture and appearance of the finished product. Freezing is a step where the ice-cream mix is cooled to freezing temperature, the water will get converted in ice crystals and hardened the finished product. Freezing will also help in maintaining the aerated structure of ice-cream and thus provide good body and proper texture.

Overrun

Overrun of ice-cream is the volume of ice cream obtained in excess of the volume of the ice-cream mix. It is usually expressed as percentage of overrun. More overrun gives soft and fluffy ice-cream.

Coagulation

It refers to clotting of milk protein due to increase in acidity (change in pH), heat denaturation or enzyme (rennet) action. It can be get achieved by addition of organic acids (Acid Coagulation) like Citric acid or Acetic acid for Paneer making, or by addition of enzyme (rennet coagulation) for Cheese making. The process of coagulating milk by microbiologically (fermentation) using Lactic Acid Bacteria (LAB) Culture is called curdling of milk, and depending upon the type culture curd or yogurt can be made.

Whey Separation

Removal of whey from the curdled milk (by filtering, pressing or hanging) to get the desired product (i.e. Chenna, Paneer, Cheese or Chakka).

Chenna

It refers to the milk-solids obtained by the acid coagulation of boiled hot whole milk and subsequent drainage of whey by gentle pressing. The acids commonly used are lactic or citric acid, in both natural and chemical forms.

Rasgulla

It is a milk based sweet made by curdling milk, draining the whey and kneading the milk solids (i.e. chenna) to make balls. These balls are cooked in hot sugar syrup until light and spongy.

Pressing and Molding

After Coagulation, the pressing is done for the whey separation and convert it into mold to give a shape.

Paneer

Paneer is an acid coagulated product obtained, when standardized milk coagulated with the permitted acids at specified temperature, resultant coagulum is filtered and pressed to get the solid curd mass. Paneer has firm, close, cohesive and spongy body and smooth texture.

Salting

This refers to the addition of common salt to the cheese. Salt in cheese affects flavour, body and texture and keeping quality. Cheese without salt are soft, ripen quickly and rapidly develop unpleasant flavours.

Maturation

Cheese maturation is the scientific process which develops the flavour and texture of cheese over time.

Cheese

Cheese is the curd or substance formed by the coagulation of milk of certain mammals by rennet or similar enzymes in the presence of lactic acid produced by added or adventitious microorganisms, from which part of the moisture has been removed by cutting, warming and pressing, which has been shaped in mould and then ripened (also un-ripened) by holding for sometimes at suitable temperatures and humidity.

Curd/ Yoghurt

Fermented dairy product, produced by fermentation process by deliberately adding live, harmless, lactic acid producing bacteria in the form of bacterial culture to milk.

Whey Beverages

The whey obtained as a by-product of paneer, cheese or chakka process, can be blended with suitable fruit juices and converted into beverages.

Chakka

Chakka is a fermented, intermediate dairy product used for production of Srikhand. Chakka can be described as strained dahi (hung curd), in other words it is the curd mass obtained after removing whey from dahi, either through muslin cloth or basket centrifuge.

Srikhand

Srikhand is a popular fermented, sweetened, indigenous dairy product having semi solid consistency with typical sweetish-sour taste. It is prepared by mixing chakka (Strained dahi), with sugar, color, flavor, spices and other ingredients like fruit pulp, nuts etc. to form soft homogenous mass.

Churning

Cream is agitated, and eventually butter granules form, grow larger, and coalesce. In the end, there are two phases left: a semisolid mass of butter, and the liquid left over, which is the buttermilk.

Butter

Butter may be defined as a fat concentrate which is obtained by churning cream, gathering the fat into compact mass and then working it.

Buttermilk

The fluid remaining when the fat is removed by churning cream into butter. It was formerly used as a beverage, but today it is mostly condensed or dried for use in the baking and frozen desserts industry.

Butter Oil

It refers to the fat concentrate obtained mainly from butter or cream by the removal of practically all the water and solids-not-fat content. The terms milk fat, anhydrous milk fat, dry butter fat and dehydrated butter fat are used synonymously with butter oil, but the raw material for their preparation is usually cream.

Evaporation

Heating of milk to thickened and concentrate.

Condensing

It is the removal of water from the standardized milk by boiling it at a low temperature till the desired concentration is reached.

Condensed Milk

Condensed milk is the product obtained by evaporating a part of the water of whole milk, or fully or partly skimmed milk with or without the addition of sugar. However, in the dairy industry, the term condensed milk is commonly used when referring to sweetened condensed whole milk.

Khoa

It is a concentrated whole milk product obtained by open pan condensing of milk under atmospheric pressure. It is also refered as Khava or Mawa. There are basically three main types or varieties of khoa, namely; Pindi, Dhap and Danedar.

Burfi

Burfi is a basic fudge from Indian cuisine that is made using full fat milk, sugar and ghee. The concentrated solid mass is poured in a tray and allowed to cool. Then it cut into cubes of desired size.

Peda

Peda is a fairly general term that refers to a wide variety of spherical or round, delicious milk-based fudge treats. Typically, they are made with a combination of dried milk solids (khoa or mawa), sugar and milk, and any preferred flavouring spices. The mixture is simmered on the stovetop until reduced to a thick consistency, which is then cooled and shaped.

Basundi

It is a sweetened condensed milk made by boiling milk on low heat until the milk is reduced by half. In North India, a similar dish goes by the name rabri.

Rabri

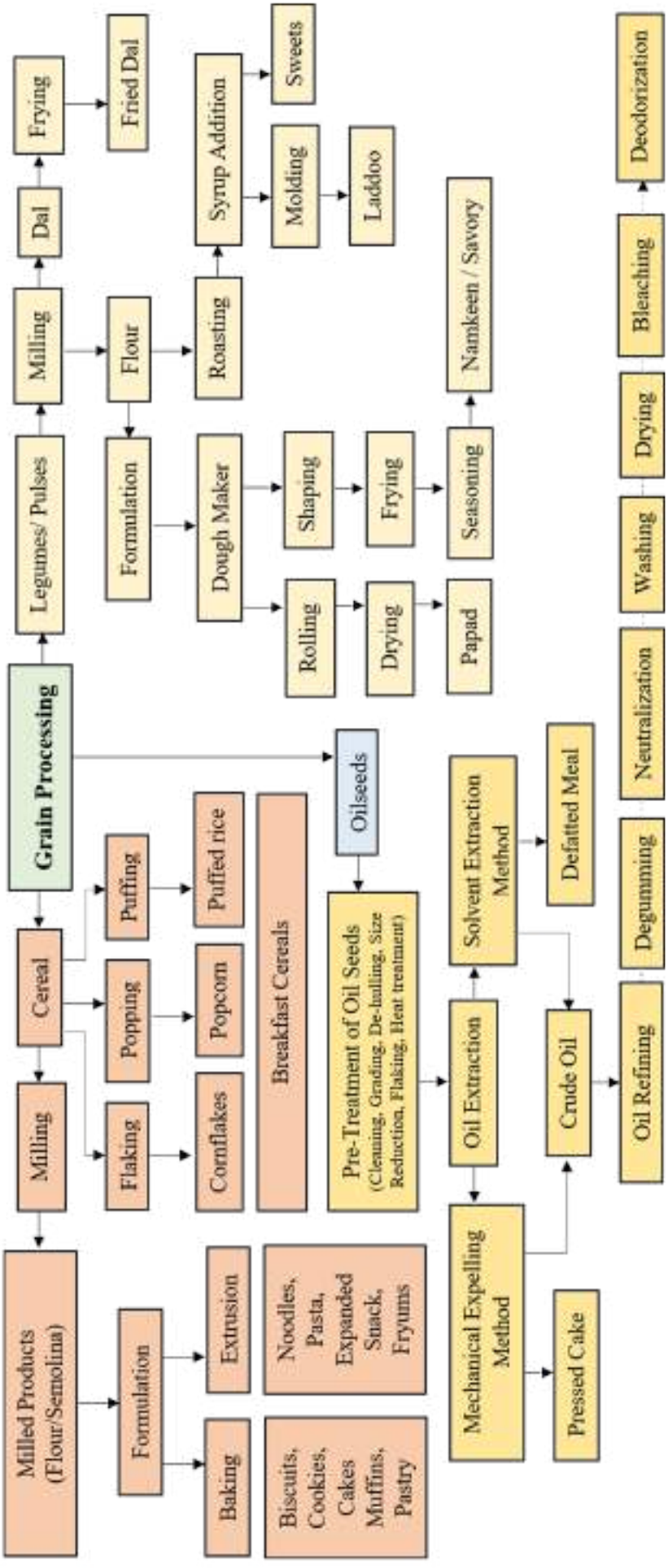
it is one of the form of condensed milk in which the cream is scraped off from the whole milk and the volume of milk has been considerably reduced, sugar is added to it and the layers of cream are immersed in the mixture and the finished product obtained by heating the whole mass for another short period.

Spray Drying

The spray drying process involves the atomization of a solution, slurry, or emulsion (Liquid Milk) containing one or more components of the desired product into droplets by spraying followed by the rapid evaporation of the sprayed droplets into solid powder (Milk Powder) by hot air at a certain temperature and pressure.

1.9 Summarized flow chart for different domains of Grain Based Product Processing

Grains, commonly referred to as cereals (maize, wheat, millet, rice, millets), pulses (beans, peas, cowpeas), oilseeds (soybean, sunflower, linseed), which are the edible seeds which are nutritionally superior. The cereals are rich in carbohydrate, pulses are rich in protein and oilseeds are rich source of oil. Based on these properties, these grains are processed into variety of value added products. The flow chart given below represents various unit operations of different product lines.


Grain Processing
Legumes/ Pulses
Milling
Dal
Frying
Fried Dal
Flour
Formulation
Dough Maker
Rolling
Drying
Papad
Shaping
Frying
Seasoning
Namkeen / Savory
Roasting
Syrup Addition
Sweets
Molding
Laddoo
Cereal
Milling
Milled Products (Flour/Semolina)
Formulation
Extrusion
Noodles, Pasta, Expanded Snack, Fryums
Baking
Biscuits, Cookies, Cakes Muffins, Pastry
Puffing
Puffed rice
Popping
Popcorn
Flaking
Cornflakes
Breakfast Cereals
Oilseeds
Pre-Treatment of Oil Seeds
(Cleaning, Grading, De-hulling, Size Reduction, Flaking, Heat treatment)
Oil Extraction
Mechanical Expelling Method
Pressed Cake
Solvent Extraction Method
Defatted Meal
Crude Oil
Oil Refining
Degumming
Neutralization
Washing
Drying
Bleaching
Deodorization

1.10 Unit Operations in Grain Processing Industry

A. Cereals Processing

Milling

Milling is a process in which grains such as oats, wheat, rice, and corn are dehulled and ground into semolina or fine flours to improve palatability, reduce cooking time, and prepare various food products. The milling of cereal grains includes the removal of tough outer fibrous layer known as hull or husk followed by crushing, grinding and screening. Below are some of the images of milled products obtained after milling of cereal grains.

Soji

Rava

Whole Wheat Flour

Refined Wheat Flour

Formulation

It is a step in which all the ingredients are formulated according to the required product. Based on the technology or method of food processing the ingredients amount will get calculated and mixed to form either a dough or batter. The quality of any grain based value added product largely depends upon formulation.

Baking

It is an art of cooking food by the action of dry heat in an oven. Generally, the temperature used for baking is 160°C to 180°C. The products prepared by using this technique are called bakery products. E.g. Bread, Cakes, Pastries, Biscuits, Cookies and other value added bakery products.

Bread

Cake

Cookies

Biscuits

Extrusion

Extrusion is the process of continuous mixing, kneading and shaping of moistened cereal flours into a product of uniform shape, size and density by combination of heat, pressure and mechanical shear. The extrusion process can be a cold extrusion or a hot extrusion process. Noodle and Pasta products can be get manufactured cold extrusion method and products like expanded snacks and fryums are manufactured by using hot extrusion method.

Extruded Products

Extruded products are made from moistened semolina or refined wheat flour, with or without other ingredients and extruding it through and extrusion press fitted with a die of the desired shape. The extruded products are then cut to a given length and then dried to definite moisture content under controlled conditions of temperature and humidity. E.g., Noodles, Pasta, Puffed Snacks and other value added products.

Breakfast Cereals

Breakfast cereals are processed grains for human consumption, typically packaged for sale as either ready-to-eat (RTE) or hot cereals (HC), requiring cooking before consumption. Breakfast cereal processing falls in the categories of flaking, popping, puffing or extrusion. Breakfast cereals are commonly made with corn, rice, oats, and wheat. These products are then seasoned or coated with sugar/caramel to enhance the palatability.

Flaking

A process of pressing or compressing and shearing whole grains or grits into thin flake. The machine is called roller flaker. The example of this is Cornflakes.

Popping

In this process a simultaneous starch gelatinization and expansion happens, during which grains are exposed to high temperatures for short time. During this, vapor produced inside the grains creates pressure inside the grain and when exposed to pressure difference the grain endosperm expands the suddenly, and pops out by breaking out the bran layer. E.g. Popcorn.

Puffing

Puffed cereals are often used as breakfast cereals or as snack food. During puffing, grains are exposed to a very high steam pressure which causes the grain to burst open. The puffed grains can be further processed by toasting, coating or mixing with other ingredients. E.g. Puffed rice. This can be also achieved by using puffing extruder.

B. Legumes / Pulses processing

Milling:

The legumes /pulses are milled to either obtain dhal or flour. De-hulled is a process which removes the outermost hull layer from the grain. The dehulled grain is then splitted into two equal disk like product which is called as Dal/Dhal. The whole process is then called as dal milling. legumes may be wet-milled or dry-milled. The whole grain or dal is then milled to obtain a product of smaller particle size (flour).

Dal: Dal are dried, split pulses that require or not require soaking before cooking.

Ready to Cook (RTC) Dal: Foods that are processed and/ or prepared to be ready to cook with very little additional effort.

Ready-to-Eat (RTE) Dal: The dal is soaked and deep fried to obtain a crispy, ready-to-eat snack.

Channa Dal

Channa Dal Sambar

Fried Channa Dal

Legume / Pulse Papad Making

Basically, Black Gram (Urad Dal) Flour is used in papad making. The flour is then mixed with water, salt, papad khar and crushed black pepper, and kneaded into a dough. The dough is then rolled or sheeting, using papad making machine and the sheet is then cut into round shape. This is then dried either in sun or by using mechanical drier.

Legume/Pulse Based Sweets

Basically, Bengal Gram Flour (Besan) is used for sweets making viz. Laddo, Mysure Pak etc. For this the flour is roasted with or without ghee. Then sugar syrup is added in it. The cooked mass is then shaped by hand or molding into different forms.

Legume/Pulse Based Namkeen:

Legume or Pulse flour is mixed with water and other ingredients to convert into soft dough. It is then fed into namkeen making machine to form fine stings which are then fried to acquire crispy texture. E.g. Shev and Bhujiya

C. Oilseeds Processs

Pre-treatment of Oil Seeds: Oilseed are rich in oil. To facilitate oil extraction from the oilseed it is important to pretreat the oilseed. Following are the methods of pretreatment.

Cleaning

Cleaning of oilseed includes removal of extraneous matters which may interfere with the efficiency oil extraction process. It can be get done by dry cleaning or wet cleaning also.

Grading

Grading of oilseeds is required to establish their general quality based on soundness, moisture content and freedom from impurities and also to evaluate their oil milling quality based on yield and quality of oil.

Dehulling

The hulls of oilseeds are fibrous and have low oil content. Dehulling of oilseeds extraction is advantageous as the hulls, reduce the total oil yields and the capacity of extraction equipment.

Size Reduction

The extraction of oil from oilseeds, either by mechanical expression or by means of solvents, is facilitated by reduction of the seed in small particles by grinding or rolling.

Flaking

It increases the surface area which is essential for solvent extraction process. The oilseeds are flaked by using flaking rollers.

Heat Treatment

Heating of oilseed facilitates the oil expelling process, by denaturing the protein.

Oil Extraction

Extraction of oil from oilseed is carried out by two methods, which largely depends on oil content of oilseed.

Mechanical Method / Oil Expelling Method

This method is used for oilseed with high oil content. The oil from the oilseed is expelled out by pressing the oilseed using screw fitted inside the chamber. The extracted oil coming out from the barrel screen and the de-oiled cake/ pressed cake is discharged at the another end of the screw.

Solvent Extraction Method

The prepared oilseeds (Grinded or Flaked) are mixed with organic solvent. Hexane (boiling point 146-156°F) is widely used solvent for vegetable oil extraction and gives higher efficiency. The oil present in the oilseed get dissolved in the solvent. The solvent is then evaporated to recover the extracted oil. This is the most efficient technique to recover oil from oilseeds. The solid waste remained after solvent extraction is called defatted meal.

Oil Refining

The oil extracted either by mechanical expelling method or by solvent extraction method contain impurities and hence called as crude oil. The process of removing the impurities from crude oil and to convert it into edible oil is called refining of oil. This includes different steps like Degumming

(remove the gum), Neutralization (removes free fatty acids), Washing (removes traces of neutralizers used), Drying (removes water used for washing), Bleaching (removes pigment and makes it light in colour), and Deodorization (removes volatile compounds which would cause off odours and tastes in the final product). The oil is then called refined oil.

Chapter – II

Technology Solutions for Food Processing and Showcase of Existing Product Specific Training Material

2.1 Introduction

Ministry of Food Processing Industry (MoFPI) has launched the PM FME scheme under the Aatmanirbhar Bharat Abhiyan with the aim to enhance the competitiveness of existing individual micro-enterprises in the unorganized segment of the food processing industry and promote formalization of the sector. The scheme to be implemented over a period of five years from 2020-21 to 2024-25 with a total outlay of Rupees 10,000 crore. The scheme has a special focus on supporting Groups engaged in Agri-food processing such as Farmer Producer Organizations (FPOs), Self Help Groups (SHGs) and Producers Cooperatives along with their entire value chain. Ministry of Food Processing Industries (MoFPI), in partnership with the State / UT Governments will provide continuous support on financial, technical and business aspects for upgradation of existing micro food processing enterprises.

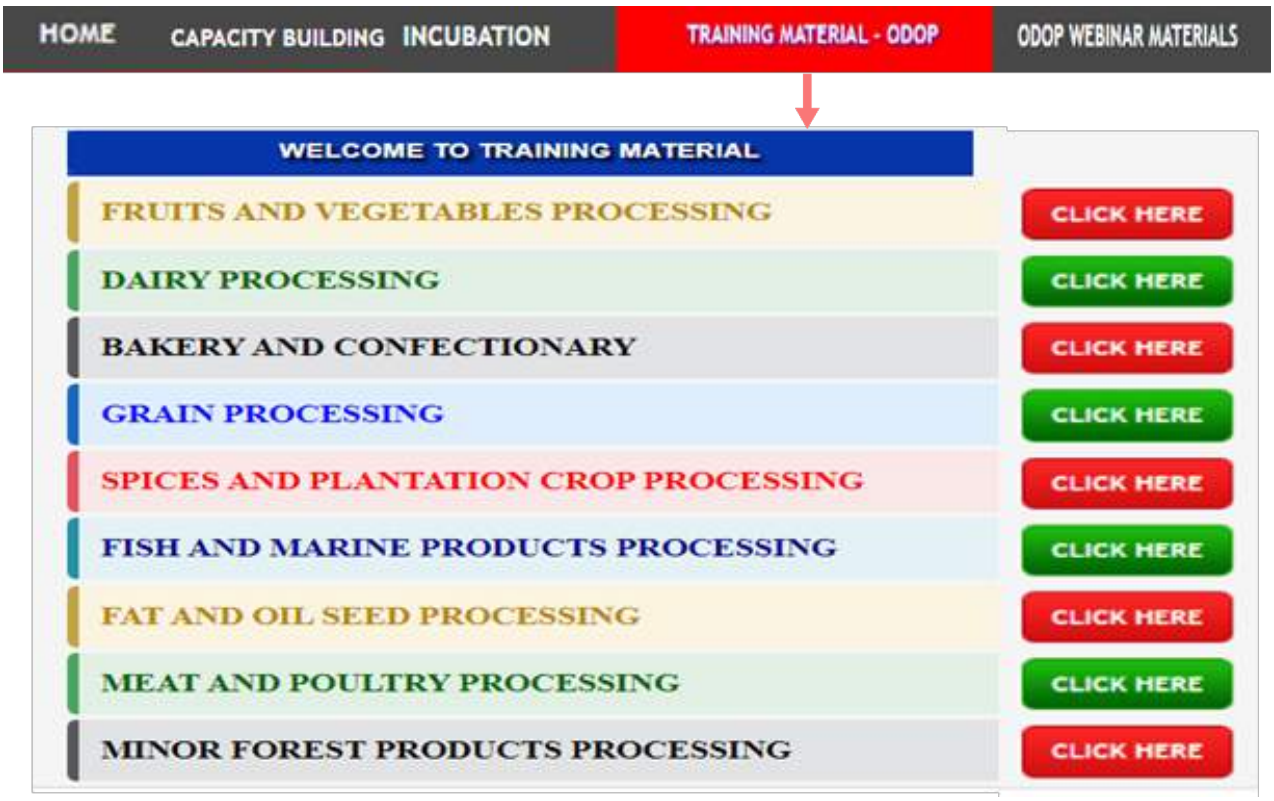
Under Capacity building component, NIFTEM Thanjavur and NIFTEM Kundli have developed various training materials and knowledge modules concerning the technical need in food processing. Under this chapter clear explanation about the PMFME web portal especially the capacity building component is given by providing screenshots of the portal for easy understanding and to facilitate the use of portal by the beneficiaries. Through this portal, people can also access the scheme guidelines, mandatory requirements for availing the subsidy of the scheme, ODOP products allotted for each district and training materials uploaded to provide basic technical knowledge on the processing of different commodities.

2.2 Food Knowledge Building by NIFTEM-T

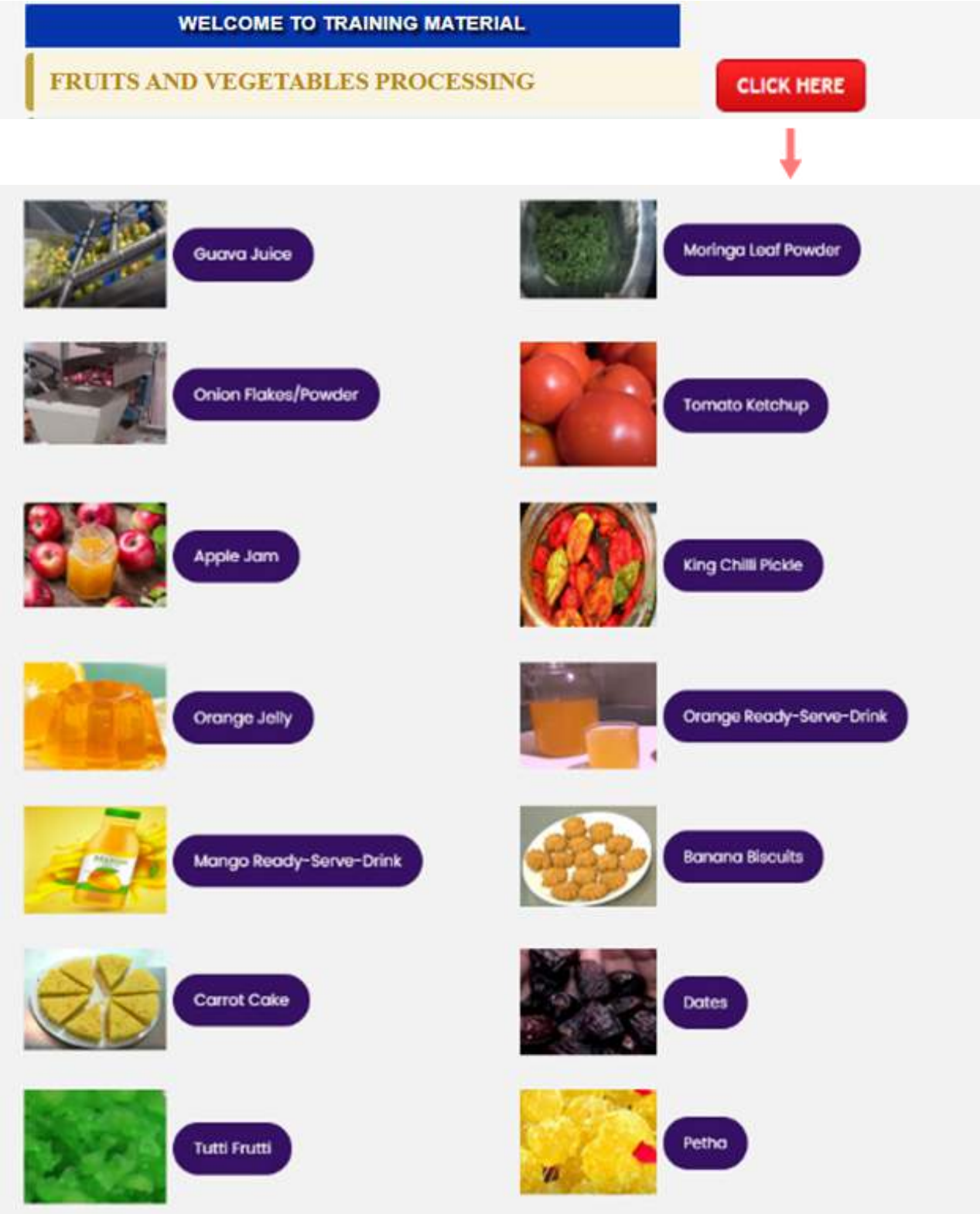
In the Home Page different tabs are available for different components of the scheme which are discussed in detail by providing the screenshots of the web page.

2.2.1 Training Material

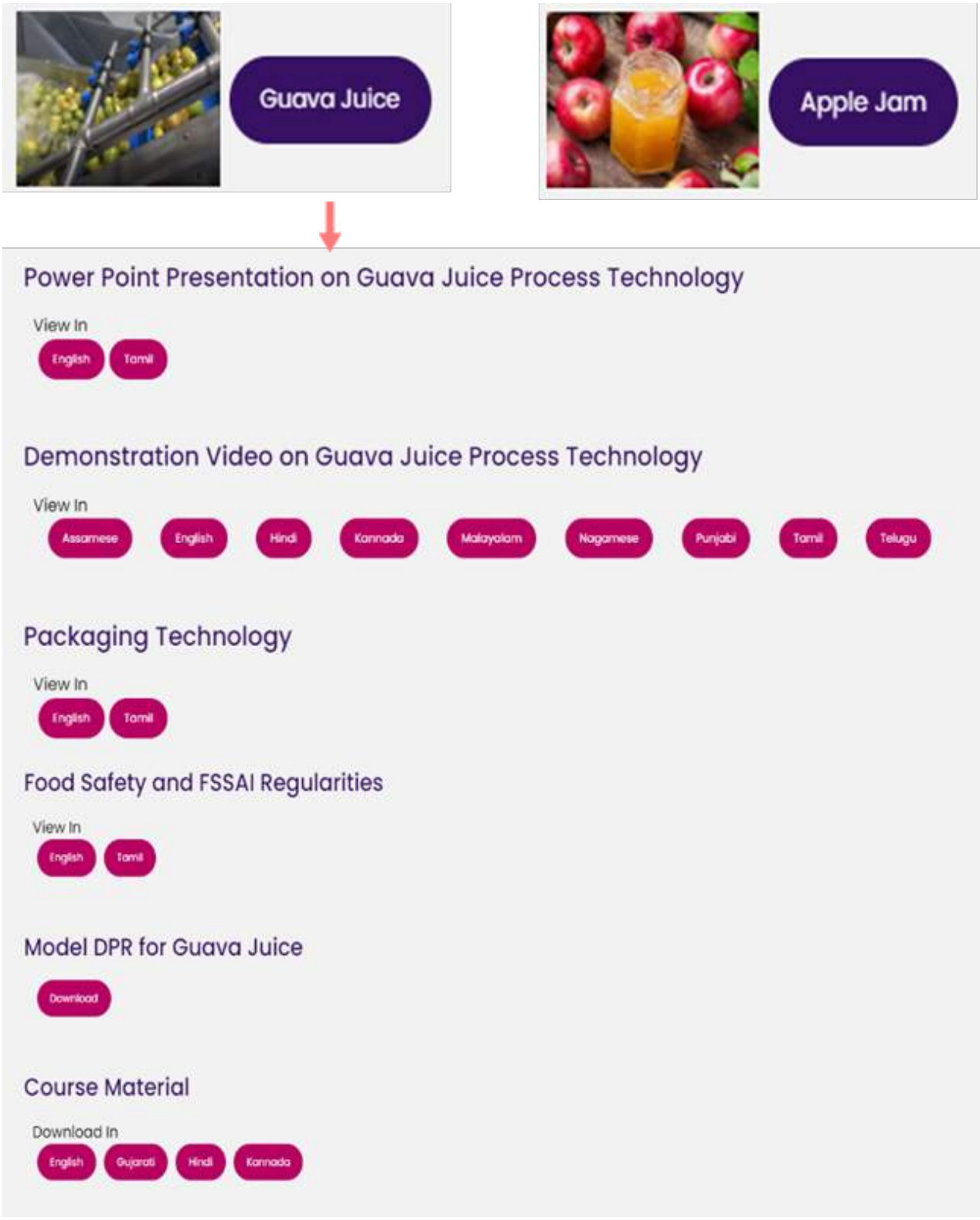
Under the PMFME scheme, training materials are uploaded under the training material tab under various domains. There are nine major domain bifurcation as shown above.



Under Fruits & Vegetables Domain various fruit based value added products are listed out as shown below



If any of the listed products is selected under the domain of Fruits & Vegetables, the page will be displayed as shown below.



For Example, if Guava Juice is selected it includes Power Point Presentation on processing of the Guava Juice, Demonstration videos on the unit operations and the machineries involved in the processing. The processing videos are available in many regional languages such as Tamil, Kannada, Malayalam, Punjabi, Telugu, Assamese.

PROCESSING OF GUAVA JUICE PPT

DEMONSTRATION VIDEO

Recent packaging technologies, criteria to be considered in the selection of packaging materials, packaging equipment used in the processing of the specific commodity as per the market trend.

FSSAI Licensing Procedure, Standardized Product List, Food Safety Standards and Regulations such as Limit of Preservatives, artificial sweeteners, emulsifiers and other antioxidants required for the extension of shelf life and enhancing the quality aspects of the products are also provided in the PPT format.

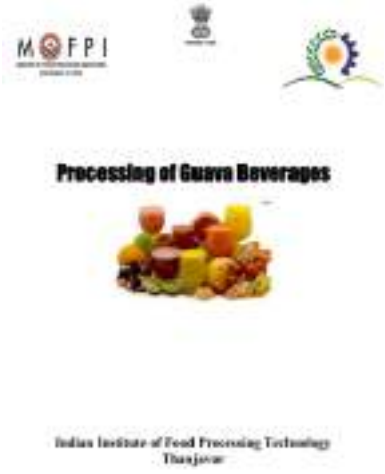
PACKAGING TECHNOLOGY PPT

FOOD SAFETY & FSSAI REGULATIONS PPT

The Model Detailed Project Report (DPR) covers about the Market Demand and Supply, Capital Investment, Working Capital requirement and other financial projections to be taken into consideration is provided as a reference material for micro / small scale entrepreneurs for preparing the DPR based on their own projections of their estimated project cost.

The course material which is a product specific manual serves as a complete guide with the set of instructions to be followed in the plant / industry starting from the processing to quality evaluation of the finished product is provided in the downloadable format to the beneficiaries.

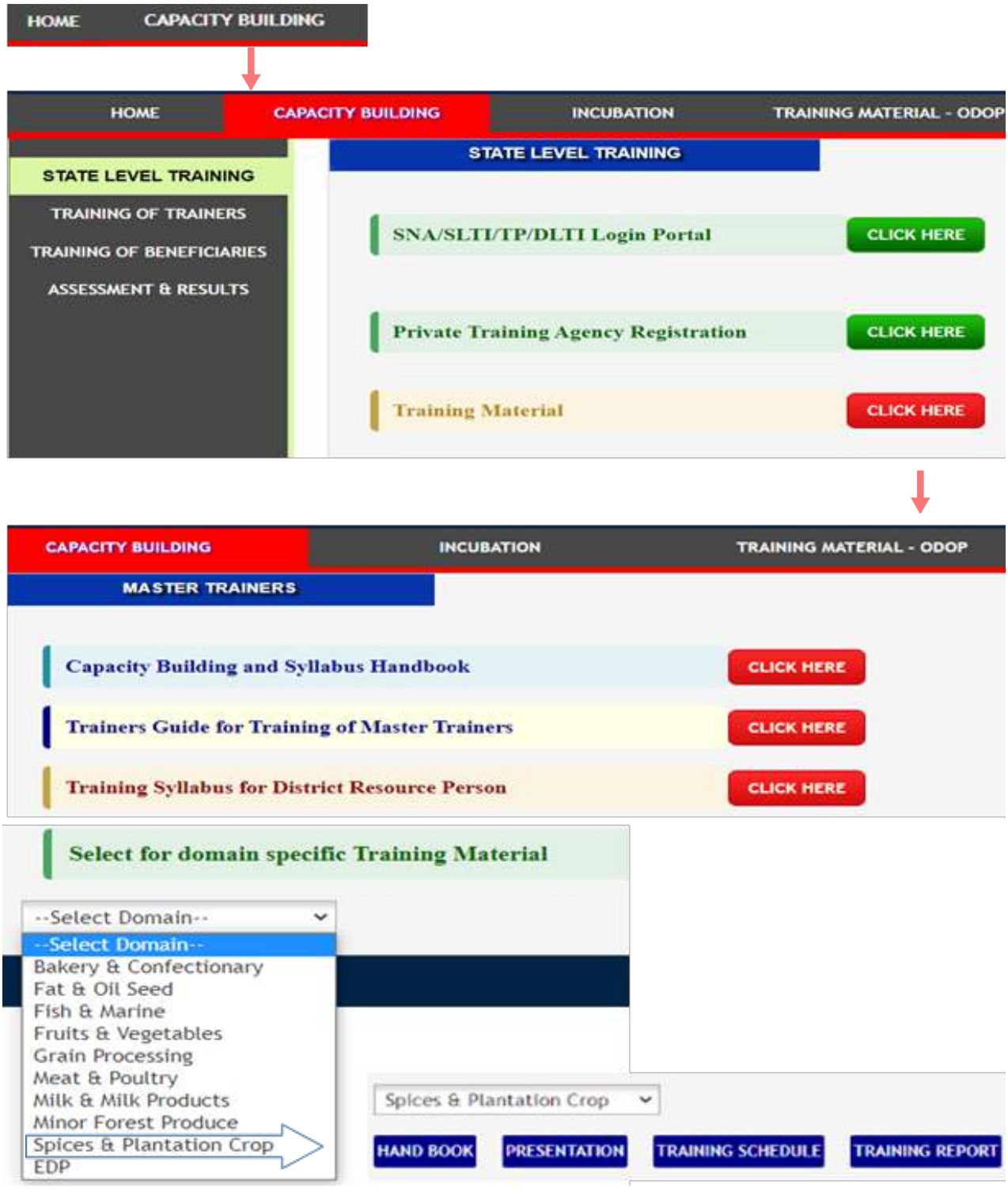
MODEL DETAILED PROJECT REPORT



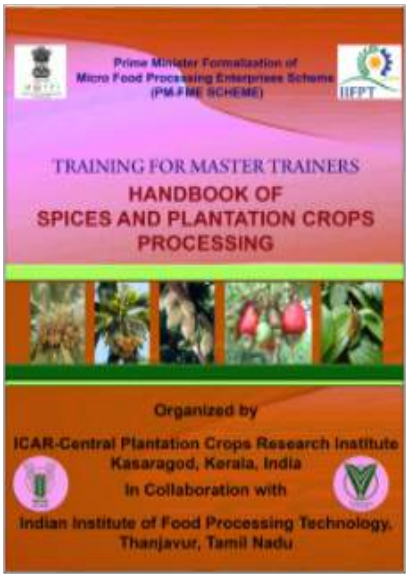
COURSE MATERIAL PPT

2.2.2 Capacity Building

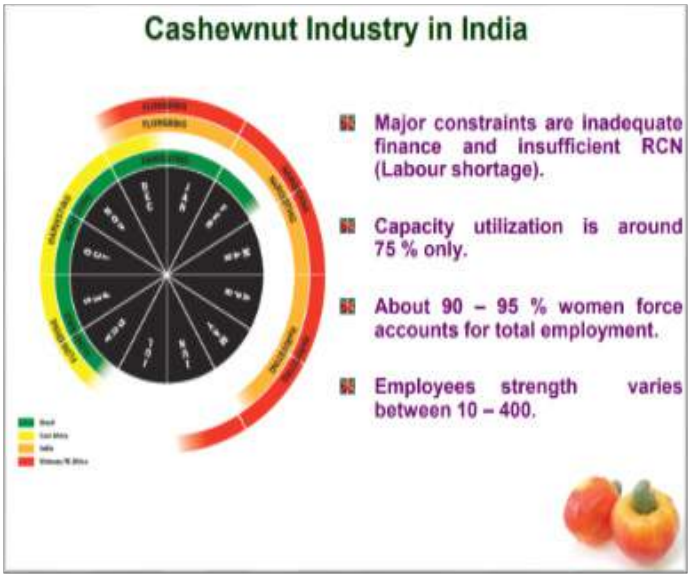
Another Important Component in the scheme is Capacity building component under which various training is conducted for beneficiaries, Master Trainers and District Resource Persons for upgrading their technical knowledge and obtaining clarification of their queries related to the scheme and to discuss the issues faced in root level implementation for achieving the major milestones of the scheme.



Under the Capacity Building Component Tab State Nodal Agency, Private Training Agency Registration and login tabs are provided as shown above. Through this login SNA will upload the details of District Resource Persons (DRPs) and other training assessment details in the portal. The training materials such as handbook and presentations are provided for the use of trainers and beneficiaries from which they can find the technical details of the specific commodities based on the domain.



HANDBOOK



PRESENTATION ON SPICES & PLANTATION CROPS PROCESSING

The handbook and Presentation includes the Post-harvest processing and preservation of spices and plantation crops especially coconut, tea, cashew, coffee and food quality and safety standards of coconut based value added products which includes Virgin Coconut Oil (VCO), Desiccated Coconut, Coconut Protein Powder, Neera / Kalparasa, Coconut chips, utilization of by-products obtained from the value addition of coconut, techno economic feasibility, packaging of whole and ground spices, criteria to be considered in the selection of packaging materials, packaging machineries to be used in the spice industry. It also covers about the conditions to be considered in the selection of site location, principles of material handling, Plant layout and maintenance, Standard Operating Procedures, general sanitary standards and controls such as GMP, GHP, GLP to be implemented in the plant, Food Safety Regulations & Certifications. Moreover, it facilitates the information on development of entrepreneurship skills such as verbal and listening soft skills, presentation skills, core and corporate soft skills which are much needed to an entrepreneur to shine in any kind of business.

2.2.3. ODOP Webinar Materials

National ODOP webinars are conducted on Processing & Value addition of different products such as citrus, Mango, Pulse, Jaggery, Rice, Vegetables, Potato, Millet, Milk, Tomato, Fish etc. In this webinar advanced processing methods, supply chain management, machineries and plant layout, food safety and FSSAI regulations, DPR preparation, marketing strategies for citrus based value added products are covered by technical experts of the particular domain. Moreover, this serves as a common platform to share the technical information to establish a small scale / micro food processing plant on specific products.

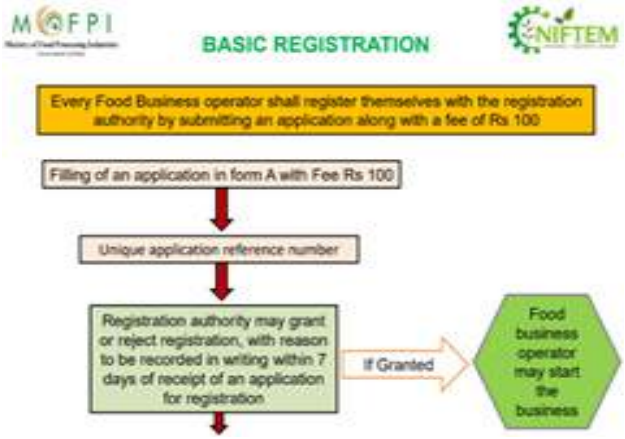
2.3 Food Knowledge Building by NIFTEM-K

NIFTEM Kundli has developed the domain wise training materials for both ODOP and EDP domain. Under the ODOP Domain tab eight domain categorization are provided as shown in the picture.

For Example, if any one of the domains i.e. Aqua Fish and Marine Processing is selected resource materials of all the value added products from that particular domain such as Power Point

Presentations of the Processing and Packaging technologies, Food Safety Standards and Regulations, The Model Detailed Project Report (DPR), Course Material etc. will appear in the subsequent page.

PROCESSING OF FISH PPT



FOOD SAFETY & FSSAI REGULATION PPT

PACKAGING TECHNOLOGY PPT

MODEL DETAILED PROJECT REPORT

COURSE MATERIAL

As a part of Entrepreneurship Development Domain, resource materials such as learning materials, videos are available for providing specific technical knowledge on Marketing & branding aspects of new products, Opportunity, Constraints & Feasibility of Micro Enterprises, FSSAI standards and other compliances required for starting an enterprise, IPR issues for entrepreneurs, Criteria to be considered in the preparation of DPR. Moreover, this serves as a technical platform to get access to the knowledge on micro food business management to the micro level entrepreneurs.

Tutorials on Micro Food Business Management

S.No.	EDP+ Domain	Reading Material	Video
1	Hygiene & FSSAI Standards		
2	Digital Marketing for MSMEs		
3	Legal Aspects & Compliances		
4	DPR and Bank Credits		
5	Understanding Financial Statements		
6	Marketing & Branding		
7	New Product Development		
8	Creation of Enterprise		
9	IPR Issues for Entrepreneurs		
10	Market Survey and Feasibility Study		
11	Business Opportunity Identification		

2.4 Important Web links

MoFPI

https://www.mofpi.gov.in/
https://www.mofpi.gov.in/pmfme/
https://pmfme.mofpi.gov.in/pmfme/#/Home-Page

NIFTEM -T

http://niftem-t.ac.in/olapp/pmfme/web/material.php
http://niftem-t.ac.in/olapp/pmfme/web/capacity1.php
http://niftem-t.ac.in/olapp/pmfme/web/odopweb.php

NIFTEM - K

http://niftem.ac.in/newsite/pmfme/
http://niftem.ac.in/newsite/pmfme/?taining_category
=tutorials-on-micro-food-business-management

Chapter – III
Packaging Aspects for Micro Food Processing Enterprises

3.1 Introduction

In today's world packaging is universal and important tool. It surrounds, enhances and protects the food products and are utilized right from raw material procurement, processing and manufacturing through handling and storage to the final consumer. Without packaging, materials handling would be a difficult, inefficient and costly exercise and modern consumer marketing would be virtually impossible. Most of the containers in the market today are used to protect a specific quantity of product during procurement, storage, distribution and retail sales, although several are also designed for bulk supply. The quality of the individual package depends on the nature, uniqueness and value of the product besides the prevailing social practices and legislation.
The selection of a packaging, storage and distribution system will depend on existing economic ability, production and distribution efficiency, retailing pattern, consumer preferences and ecological aspects.

Definition of Packaging Material

Packaging materials are used to enclose or hold together the manufactured goods.

Definition of Packing

Packing is a process of wrapping up of product into a case or container (packaging material), for the purpose of protection. The main objective of packing is to provide safety.

Definition of Packaging

Packaging is the process of enclosing the product in order to identify the brand and also ensures its safety for storage and transport.

The packaging institute international defines packaging as the enclosure of products, items or packages in a wrapped pouch, bag, box, cup, tray, can, tube, bottle or other container form to perform one or more of the following functions: containment, protection and / or preservation, communication and utility of performance. If the device or container performs one or more of these functions it is considered a package.

3.2 Function of food packaging

The function of a package is "to preserve the quality and freshness of food, to add appeal to the food to attract consumers, and to facilitate its storage and distribution." The basic functions required of a package can be grouped under five major categories.

Containment

The containment function involves the ability of the packaging to maintain its integrity during the handling involved in filling, sealing, processing, transportation, marketing, and dispensing of the food.

Protection

The need for protection depend on the food product but generally includes prevention of biological contamination (from microorganisms, insects, rodents), oxidation (of lipids, flavors, colors, vitamins, etc.,), moisture change (which affects microbial growth, oxidation rates and food texture), and

physical damage (abrasion, fracture). Protection can also include providing tamper evident features on the package. In providing protection, packaging maintains food safety and quality achieved by refrigeration, freezing, drying, heat processing, and other preservation of foods.

Preservation

Product protection is the most important function of packaging. Protection means the establishment of a barrier between the contained product and the environment that competes with man for the product.

Convenience

Providing convenience to consumers has become a more important functions of packaging. Range of sizes, easy handling, easy opening and dispensing, resealability, and food preparation in the package are examples of packaging providing convenience to the consumer.

Communication

Packaging provides brands communications to the consumers by the use of symbols, illustrations, advertising and colour, thereby creating visual impact.

Other functions of packaging

Other functions of packaging include apportionment of the product into standard unit of weight, measure, or quantity prior to purchase. Yet another objective is to facilitate product use by the consumer with devices such as spouts, squeeze bottle, and spray cans.

3.3 Types of packaging

Packaging may be looked at several different types. For example, a transport package or distribution package is the package form used to ship, store, and handle the product or inner packages. Some identify a consumer package as one which directed toward a consumer or household. It is sometimes convenient to categorize package by layer or function: primary, secondary, etc.
Based on the convenience and contact of food product with the packaging, the packaging system is classified into three main groups, as given below.

A. Primary packaging

It is the material that first envelops the product and holds it. This usually is the smallest unit of distribution or use and is the package which is in direct contact with the contents (butter in parchment paper). Thus this packaging is in direct contact with food product and contains the product. The primary packaging should be complementary to the type of product being packed inside it. Also, the type of primary packaging will depend upon the use of secondary and tertiary packaging system or not.

B. Secondary packaging

It is the immediate outside packaging system to the primary packaging. It is basically used to group

primary packages together (paper board pack containing food) and form a unit pack, where the handling and transportation of small packets are not convenient. It provides additional protection to the primarily packed food product.

C. Tertiary packaging

It is used for bulk handling, warehouse storage and transport shipping purpose. The product packed in primary and/or then in secondary are placed in large cartoon or box. These boxes (Boxes containing 30 -50 biscuit packs are put together). are then palletized into one unit load that packs tightly into containers.

3.4 Types of packaging materials

The food is packaged and packed with the aim of being transported and stored. That is, not only is it a container, but 'the container must protect what it sells and sell what it protects' taking care of the interactions between food and packaging materials. From the business perspective, the appearance of packaging is particularly important because it identifies the product in the distribution chain and differentiates it when it reaches the consumers.

The use of industrial materials for packaging foods is a recent trend. The most commonly used industrial materials are:

A. Paper and cardboard
B. Metals
C. Glass
D. Flexible plastic films
E. Wood

A. Paper

Paper is the most widely used packaging material in the world. It is made up of wood pulp or cotton fibre. Paper is inexpensive, lightweight, robust, moisture-proof, and safe for use in food items. The paper obtained from wood pulp is called board stock, while those obtained from cotton are called bag boards. Paper is manufactured in sheet form or corrugated form. The corrugated types are widely used for packaging of foods. Cellulose acetate is also used extensively for making tea bags, coffee bags, etc.

Paper is divided into two broad categories: fine papers, generally made of bleached pulp, and typically used for writing paper, bond, ledger, book and cover papers, and coarse papers, generally made of unbleached kraft softwood pulp and used for packaging.

Kraft paper

This is typically a coarse paper with exceptional strength, often made on a fourdrinier machine and then either machine-glazed on a Yankee dryer or machine-finished on a calender.

Bleached paper

These are manufactured from pulp which are relatively white, bright and soft and receptive to the special chemicals necessary to develop many functional properties. They are generally more expensive and weaker than unbleached papers. Their aesthetic appeal is frequently improved by clay coating one or both sides.

Greaseproof paper

This is a translucent, machine-finished paper which has been hydrated to give oil and grease resistance. Prolonged beating or mechanical refining is used to fibrillate and break the cellulose fibres which absorb so much water that they become superficially gelatinized and sticky.

Glassine paper

These are manufactured from pulp which are relatively white, bright and soft and receptive to the special chemicals necessary to develop many functional properties. They are generally more expensive and weaker than unbleached papers. Their aesthetic appeal is frequently improved by clay coating one or both sides.

Vegetable parchment

These are manufactured from pulp which are relatively white, bright and soft and receptive to the special chemicals necessary to develop many functional properties. They are generally more expensive and weaker than unbleached papers. Their aesthetic appeal is frequently improved by clay coating one or both sides.

Waxed paper

These are manufactured from pulp which are relatively white, bright and soft and receptive to the special chemicals necessary to develop many functional properties. They are generally more expensive and weaker than unbleached papers. Their aesthetic appeal is frequently improved by clay coating one or both sides.

Paperboards

These are manufactured from pulp which are relatively white, bright and soft and receptive to the special chemicals necessary to develop many functional properties. They are generally more expensive and weaker than unbleached papers. Their aesthetic appeal is frequently improved by clay coating one or both sides.

B. Metals

Metals is used in packaging in a variety of applications from rack systems to tuna cans. For food packaging, four types of metal are commonly used: steel, aluminium, tin, and chromium. Steel and aluminium are commonly used in production of food cans, and are the primary materials for metals packaging. Food cans are most often made of steel, and beverage cans are usually produced from aluminium. Steel tends to oxidize when it is exposed to moisture and oxygen, producing rust. Therefore, tin and chromium are used as protective layer for steel. Tinplate is a composite of tin and steel made by electrolytic coating of bare steel with a thin layer of tin to minimize corrosion. If chromium is used to provide corrosion protection instead of tin, the resulting materials is called electrolytic chromium – coated steel (ECCS) or tin-free steel (TFS). ECCS is less resistant to corrosion than tinplate but has better heat resistance and is less expensive.

Aluminium

Aluminium is a trendy materials employed as a packaging materials. The most commonly used containers for packing foods are aluminium cans. These cans have a sharp tapering of external and internal surfaces, enabling the can to stand upright and reducing the space inside the container. Aluminium cans offer complete protection against contamination and provide freshness to packed foods. However, they possess poor heat conductivity and low mechanical strength.

Tin

Tin is an alloy of copper and other metals like antimony, lead, etc. It has good heat conductivity and protection against oxidation. Tinned steel is widely used for making tin cans. The two essential properties of tins are their corrosion resistance and heat insulation property, which enable them to preserve the packed food for a longer time. However, tins are not moisture-proof and are very heavy in weight.

Can forming process

These are manufactured from pulp which are relatively white, bright and soft and receptive to the special chemicals necessary to develop many functional properties. They are generally more expensive and weaker than unbleached papers. Their aesthetic appeal is frequently improved by clay coating one or both sides.

C. Flexible plastic films

Flexible plastic films are made of PVC (polyvinyl chloride), LDPE (Low-density polyethylene), (High-density polyethylene), PP (Polypropylene), etc. Flexible films are preferred as packaging materials for foods because they are light in weight, solid, and moisture-proof. In addition to this, they offer complete protection against oxygen and other atmospheric contaminants.

The use of flexible plastic films for packaging foods has increased in the last few decades. It is estimated that about 20% of all food items are packed in flexible film.

Cellulose

Cellulose is a high molecular-weight polymer obtained from plant tissues like cotton, timber, etc. cellophane, cello tape, and various fabrics made of viscose fiber are used as packaging materials. Cellophane is the oldest and best known cellulosic film. It is manufactured from regenerated cellulose obtained by treating cotton or paper pulp with alkali and sulphuric acid under pressure. Cellophane has a poor barrier to moisture vapour but provides excellent protection against light and and ultraviolet rays. It is used for packaging fresh fruit and vegetables. Cello tape, a transparent film of regenerated cellulose, is widely employed as a wrapper for bread and pastries.

Polyethylene

Polyethylene is the most widely used plastic in the world. Various polyethylene grades are employed to make plastic containers (polybags) and plastic films. Polyethylene possesses good gas barrier properties but has poor mechanical strength. It is used in thin sheets or bags for packing foods like bread, cakes, etc.

LDPE (Low Density Polyethylene)

LDPE is a semi-crystalline structure

Melting point: 106°C to 115°C

Highly Transparency

More Flexible than HDPE

High Permeability to water and Gases

HDPE (High Density Polyethylene)

HDPE is a crystalline structure

Melting point: 125°C to 135°C

Low Transparency

More Rigid than LDPE

Low Permeability to water and Gases

Polyethylene Terephthalate

Polyethylene terephthalate (PET) is a polymer material with many characteristics that make it suitable for food product packaging. PET can be semi-rigid or rigid which makes it more impact resistant, and helps protect food or liquids inside the packaging. PET film features high tensile strength, low moisture absorption, and excellent dimensional stability throughout a wide range of temperatures. It is used for plastic bottles for carbonated drinks, bags, snack food wrappers, bottles, jars, and tubs. PET is the most widely recycled plastic in the world.

Poly Vinyl Chloride (PVC)

PVC is an inexpensive and highly versatile thermoplastic. It can be formulated as rigid or flexible plastic. It has high impact strength and good dimensional stability. It acts as a barrier to oil and grease. PVC is used in the form of cling films for foods, food serving tubs and cups, and also tablet blisters etc.

Polypropylene (PP)

Polypropylene is light in weight and possesses good moisture barrier properties. It is expensive and has poor gas barrier properties. Nowadays, polypropylene is used for making flexible pouches or sacks of small capacity for containing dry foods like coffee powder, tea powder, etc.

Polystyrene (PS)

Polystyrene (PS) is a colorless, hard plastic without much flexibility. It is commonly used to make cups, bakery trays, fast food containers and lids, hot cups and egg cartons etc.

D. Glass

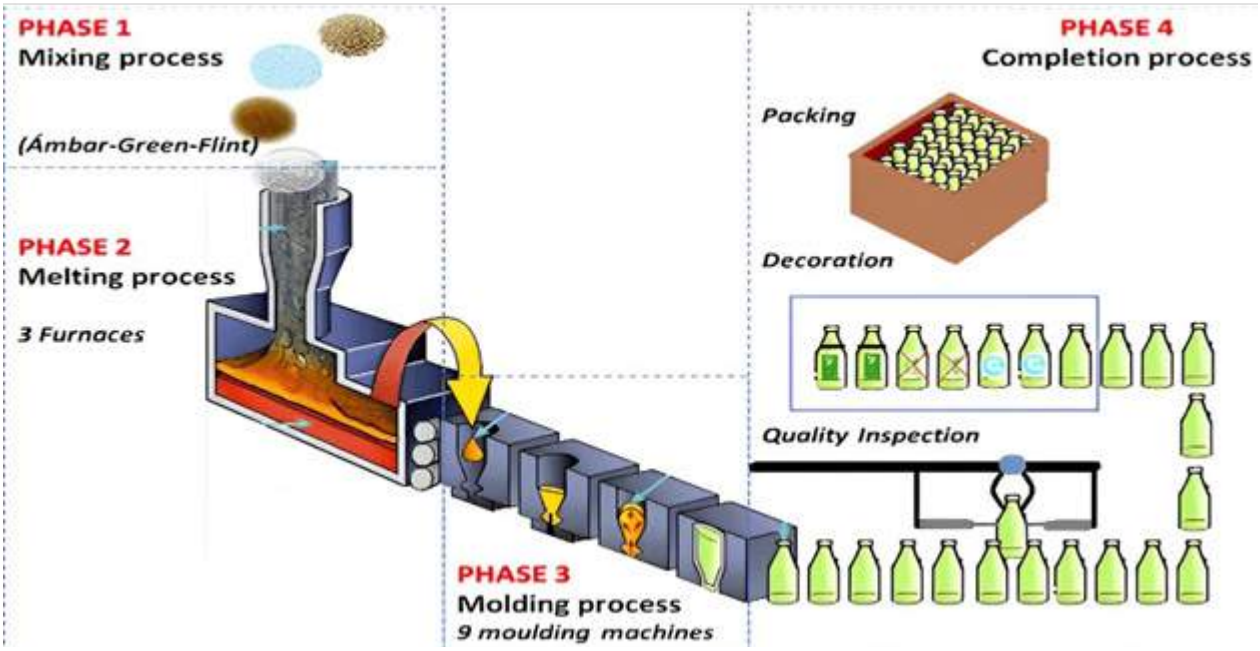
Glass is an amorphous inorganic product of fusion that has been cooled to a rigid condition without crystallizing. For food packaging, bottles or jars are the types of glass packaging most often used.

Glass is made primarily of silica, derived from sand or sandstone. For most glass, silica is combined with other raw materials in various proportions. For example, soda-lime glass, the glass typically used for food packaging, contain silica (68 -73%), limestone (10-13%), soda ash (12-15%), and alumina (1.5-2%).

Glass is inert to a wide variety of food and non-food products, very rigid and strong against pressure, transparent, and non-permeable (excellent barrier properties). However, glass has disadvantages due to its heavy weight and fragility.

Forming of glass bottle

Below is the diagrammatic representation of glass bottle forming process.



E. Wood

Wooden boxes, barrels, etc., are widely employed as packaging materials for dry solid foods like cereals, pulses, etc. Rigid boxes are water-resistant, but they absorb moisture on coming in contact with the packed food. Wood offers safe packaging for dry foods, but it is not used in modern times because of its bulky nature and low protection to packaged food.

3.5 Packaging systems

A. Form, Fill and Seal System

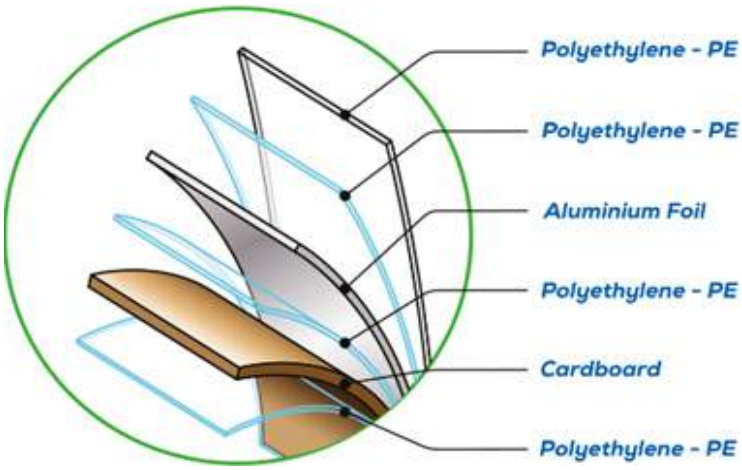
Form-Fill-Seal system is one in which the processed food product stored in a tank is continuously fed to the packaging system and gets packaged as pouch or a semi-rigid rectangular pack. This system is suitable for liquids and/or free- flowing solids only. In this the packaging material is purchased in the form of rolls. The machine unwinds the roll, sterilizes it by hydrogen peroxide or UV light, forms into a tube and then seals one end of it. The product is filled into this through a measuring mechanism and then the top

end of the tube is sealed thereby hermetically sealing the product.

The top sealing, which also acts as the bottom seal for the next package can be accompanied by a cutting action if so desired by the packer. These machine can pack 30-35 units per minute and have revolutionized the pasteurized milk packaging in the dairy industry and spices, ready mixes, etc. in other food industries.

B. Aseptic packaging system

Aseptic packaging can be defined as the filling of a commercially sterile product into a sterile container under aseptic conditions and hermetically sealing the containers so the reinfection is prevented. This results in a product, which is shelf- stable at ambient conditions. Generally, for this a multilayer pack are used, which is composed of several layers of different types of packaging materials.



C. Modified Atmosphere Packaging

MAP is the enclosure of food in a package in which the atmosphere inside the package is modified so that its composition is other than that of air. Modification can be achieved by removing air and replacing it with a controlled mixture of gases. Nitrogen is frequently used in MAP to reduce the concentration of other gases in the package.

Gases used in MAP

1. Carbon dioxide 2. Oxygen 3. Nitrogen 4. Argon

Gas mixture used in MAP and CAP

There are three types of gas mixtures used in MAP

Inert packaging (N2)

Semi-reactive blanketing
(Co2/ N2 or O2/ Co2/ N2)

Fully reactive blanketing (Co2 or O2/ Co2)

Types of MAP

Active MAP

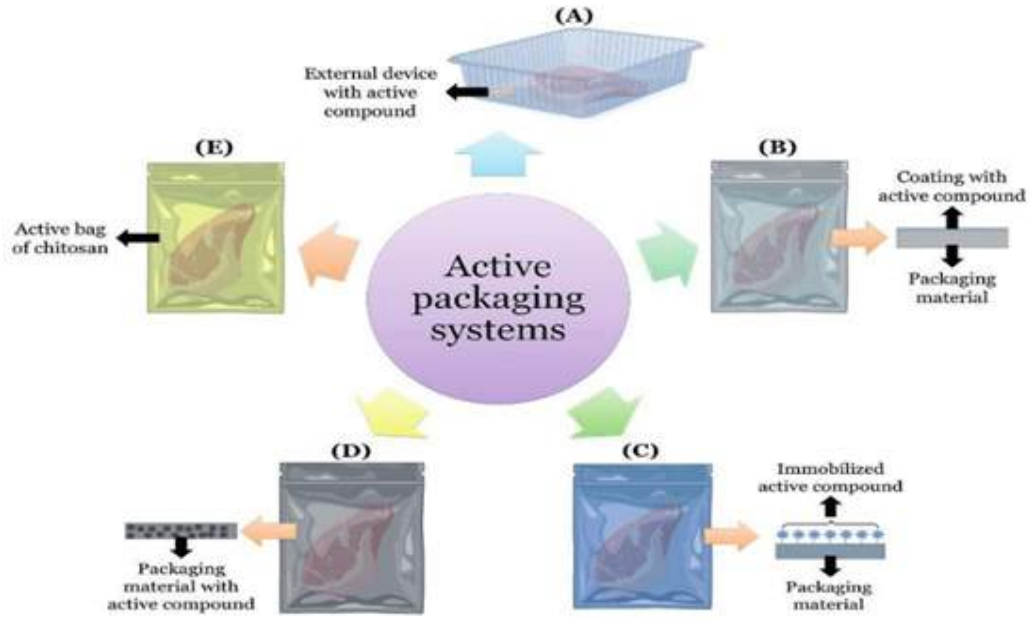
Pulling a slight vacuum and replacing the package with a desired mixture of O2/ Co2/ N2. A beneficial equilibrium atmosphere with a desired mixture may be established more quickly than a passively generated.

Passive MAP

Modified atmosphere conditions can passively evolve within a hermetically sealed package as consequences of a commodity's respiration, O2 consumption and CO2 evolution.

D. Active packaging systems

The development of active packaging systems (also termed 'intelligent' packaging or 'smart films'), is a significant new area of MAP technology.



They have the following capabilities:

Edible moisture barriers for fresh fruits and vegetables or edible oxygen barriers to prevent enzymic browning.

Ethylene scavengers- these are sachets of silica gel containing potassium permanganate, which oxidises ethylene to slow the ripening of fruits.

Oxygen scavengers to create low-oxygen atmosphere or slow the oxidation of lipids. Zeolite films to inactivates micro-organisms on food surfaces and sachet and films that release ***microbial inhibitors***.

Ethanol that is trapped in silica gel, contained in a sachet made from a film that is highly permeable to ethanol vapour, has been used to extend the shelf life of bakery products, cheese and semi-dried fish products.

E. Intelligent packaging systems

Time/temperature indicator

This indicator provides information on the temperature and displays past and present temperature variations. In storage or during shipment, it serves as an addition to labelling. Time-temperature indicators (TTI) attached to the package surface is designed for integrate the cumulative time-temperature history of the package throughout the whole distribution chain, and therefore, gives indirect information on the product quality. Time temperature indicators which are commercially available are based on various reaction mechanisms (diffusion, polymerisation or enzyme reaction).

Oxygen indicator

This indicator provides data about leakage. This indicator is used for food packaging that is stored in a controlled or modified food packaging. An alkaline substance like sodium hydroxide, a redox dye like methylene blue, and a reducing substance like reducing sugars make up a standard oxygen indicator.

Recently, oxygen indicators based on oxidative enzymes have been described. The indicator also includes additional ingredients like a solvent (water or alcohol) and a bulking agent (such as silica gel, polymers, cellulose materials, or zeolite). The indicator can be made into a tablet, label, printed layer, or laminated in a polymer film.

Carbon dioxide indicator

This indicator gives information on concentration of carbon dioxide in modified atmosphere packaging. The usage area of this indicator is controlled or modified atmosphere packaging.

Radio Frequency Identification Tags (RFID)

Wireless data collection technology, uses electronic tags for storing data and identification of animals, objects or people. Tags attached to assets (pallets, cattle, packs, meat bins) to transmit information to a reader. Tags are could be classified into two categories; first one is passive tag which is cheap, simple, short-range, powered by energy from reader and the second one is active tag which is battery powered, longer range, more information (nutritional information, temperature, cooking instructions etc.).

Bio-Sensors

Bio-sensors are compact analytical devices that detect, transmit and record information pertaining to biological reactions. They contain bio-receptors and transducers. Bio-receptors are more specific towards recognizing the target analyte. Whereas, transducer converts biochemical signals to an electrical response in quantifiable amount.

F. Biodegradable packaging

The present global concern about petrochemical based plastic materials has generated much interest in biodegradable, or "green" packaging materials. Biodegradable plastic is defined as a degradable plastic in which the degradation results from the action of naturally occurring microorganisms such as bacteria, fungi and algae. Bio-based polymers, or biopolymers, are obtained from renewable resources.

Theses renewable resources consist of consist of proteins (whey protein, soy protein, collagen, gelatin, wheat protein etc.), polysaccharides (starch, alginates, pectin, carrageenan and chitosan/chitin) and lipid (fats, waxes and oils).

3.6 Testing of packaging materials

When packaging materials are used for particular food product, it should meet certain standards. These standards are provided by various governmental and non-governmental organizers. The standards are set for each testing method, to determine the properties of packaging material. Several packaging materials are available in the market which are intended for packaging of food products; they should meet the requirements of the packaging materials that are provided by the various organizers to ensure the safety and quality. There are various agencies that provide standards or testing methods of packaging materials.

1. American Society for Testing and Materials (ASTM)
2. International Organization for Standardization (ISO)
3. International Safe Transit Association (ISTA)
4. Technical Association of the Pulp and Paper Industry (TAPPI)

Methods for Testing Packaging Materials

The packaging materials are tested for their properties to assess their application and usability in packaging of certain food products. Below are few methods which are generally used for testing of properties of packaging materials.

1. Physical properties
2. Chemical Testing of Packaging Material
3. Analysis of Mechanical Properties
4. Biodegradability Testing
5. Microbiological Degradation Test
6. Compost Method
7. Enzymatic Degradation Test
8. Thermal Analysis Techniques

Thickness Measurement

The accurate measurement of thickness is crucial for characterization to check whether the film meet certain specifications for storing particular product. Film thickness changes as the process parameter changes. The thickness affects the permeability and mechanical strength of films, and it also affects the product shelf life. So it is important to measure the thickness. Thickness of packaging film is usually measured using a micrometer. Screw gauge or Vernier calipers can be employed but the error will be more. Nowadays digital micrometers are used which can give extremely accurate measurement up to 0.001mm. the film to be measured is placed between anvil and spindle.

Gloss Detection

Gloss is associated with the appearance or surface shininess of packaging material. The measurement of gloss is important to predict consumer acceptance. Floss is measured using a gloss meter by projecting a fixed intensity of light at a particular angle (60, 20, or 85) onto the surface of the specimen and measuring the amount of reflected light at the opposite angle. the gloss value depends upon the refractive index of specimen. The gloss value of film changes with the molding process parameters and aberrations on the surface of film. So the gloss of the film should be measured to study the consumer acceptance.

Leak Testing

Leaks in packages occurs due to imperfections in the packaging material or improper sealing. Leakage will lead to spoilage of food product inside the packages by the entry of unwanted gases, harmful microorganisms, or other contaminants. So the detection of leaks in packed food product is important.

Types of Leak Test

1. Internal Pressurization (Bubble Test)
2. Bubble Emission
3. Vacuum Decay Method
4. Laser Measurement
5. Dye Penetration\

Water Vapor Transmission Rate

Water vapor transmission rate is the amount of water transferred through packaging material per unit time trough unit area. The main function of packaging material is to protect the product from outer environment to reduce wastage due to spoilage. The package should not allow water vapor to transmit and enter into product. Suitable packaging material should be selected according to the characteristics of the product.

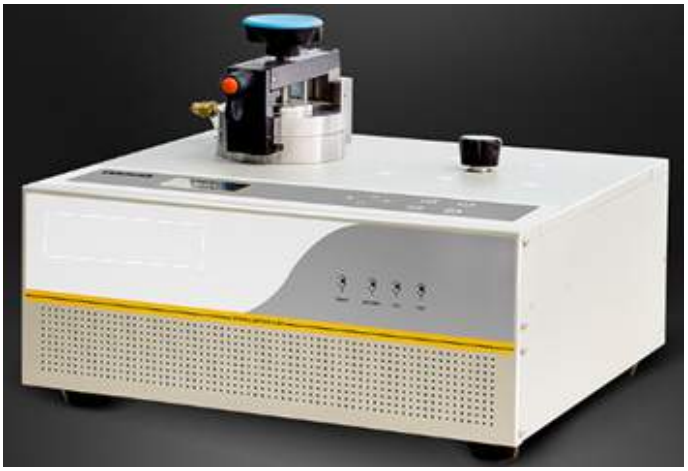
The selected material should maintain the quality of the packaged foods, so it is important to know the water vapor transmission rate of packaging material before selecting the material for packaging.

WVTR Methods

- Gravimetric Method
- Modulated Infrared Sensor
- Relative Humidity Sensor

Gas Permeability Testing

Most of food materials are sensitive to oxygen, and the shelf life of certain foods depends on the gas permeability of packaging material. Gas permeability is an important property of a packaging material which determines its suitability for the application. It depends upon the solubility of gas in the polymer material and diffusivity of gas through the material.



In this method the sample is sealed between two chambers in such a way that it acts as a semipermeable membrane. One chamber is filled with the gas being tested and kept at high pressure. The other chamber is kept at low pressure. The gases pass through the membrane and get accumulated in evacuated chamber. Based on the way in which the amount of gas is measured. In mano metric method, the lower pressure chamber is evacuated first, and the gas concentration is measured by increase in pressure. In volumetric method, the lower pressure chamber is maintained near atmospheric pressure, and the gas concentration is specified by increase in volume.

Testing of Migration from Packaging Material

The packaging material was prepared by the addition of chemical compound into various polymeric materials. These chemical compounds are added to improve the functional properties of the packaging material. During the storage and transportation of product, some of these chemicals may migrate from the packaging material to food products. If the migrated compounds in the food products exceed specified limits serious safety and quality issues arises. The migration of chemical compound occurs through diffusion which depends on several parameters including nature of food, amount of chemical compounds in film, contact time, and environmental condition.
The migration can be studied by:

Determination using stimulants
Chromatographic methods

Compression Test

Compression testing of packaging materials is done to determine the compression strength of materials such as corrugated box, paper boards, and cans. Compression strength is usually measured to study the characteristics of packaging while stacking. During stacking of containers, the container at bottom experience more force than at the top. The container should withstand the force during transportation, distribution, and handling in bulk. So it is important to study the compression strength of packaging material. The compression tester consists of a fixed head, where the container to be tested is placed, and a movable head which help to apply a fixed amount of force to the container. Compressive properties of rigid boxes or cans include modulus of elasticity, yield stress, deformation beyond yield point, and compressive strength.

Tensile Test

Tensile test measures the tensile properties of packaging materials by applying controlled tension until failure. Tension test is carried out to determine maximum load that can be applied to a material before it ruptures. Tensile properties may vary with specimen thickness, method of preparation, speed of testing, type of grips used, and manner of measuring extension. The properties measured during tensile test include:

1. Ultimate tensile strength
2. Ultimate tensile strain
3. Modulus of elasticity
4. Poisson's ratio
5. Transition strain

Vibration Test

A product may get damaged during transportation when the vibration frequency is not within the resonant frequency of the product. This kind of damage is common in fruit packaging where the skin of the fruit gets damaged due to vibration which eventually lead to spoilage. So it is important to determine the resonant frequency of the package so that adequate protection can be given to save the product from getting spoiled. It will also provide information about complex interactions between the components inside the product as they are subjected to vibration when they are kept inside the package.

Drop Test

The materials get damaged when the package is dropped on the ground during storage or transportation. This kind of failure happens in packages which are handled manually. The packages are tested for its drop resistance before selection of packaging materials, and the test conditions are simulated by drop tester. the test assesses the ability of the container to protect the product during all the conditions that occur during transportation. This test allows selecting suitable packaging materials for particular packaging.

Drop test is generally carried out for loaded boxes, cylindrical containers, and flexible packages. The drop tester consists of an adjustable plane surface on which the containers to be tested are placed. The surface possesses a special release mechanism which can be controlled by a lever. The conditioned packages are filled with indented products or dummy products which have the same dimension and characteristics, and package are dropped from a predetermined height on a rigid surface.

Chapter-IV
Domain Knowledge Developed by Indian Food Research Institutes

4.1 Introduction

Indian food research institutes are primarily working to build a knowledge on different sectors of food processing, right from cultivation, harvesting, processing and preservation. A lot of research is going on in the field of food processing, and new technologies and products are coming out as a positive result of their research activities. These institutes are also publishing their research finding and have an information system for promoting their technologies developed. These technologies can be commercialized through a technology transfer program. Along with this they are undertaking consultancy services and catering the need of the industry. By this way, these national institutes are helping in sustainable development.

These Food Research Institutes have a vision of playing a key role in the transformation of the food processing industry to be internationally competitive with particular reference to product safety, quality and presentation. These food research institutes are mandated to conduct applied market oriented research for various gaps in food industry. These gaps can be in the area of food processing and preservation, food safety, storage, marketing and distribution. These institutes also cater to the issues like national food and nutritional security and also advise government on its food policy. Some of these institutions are providing incubation support for utilization of technologies and related equipment directly by the entrepreneurs. The mission of these research institutes focus on providing scientific and technological support to the growth of the food and agricultural sectors of the national economy.

Objectives of Food Research Institutes

- Generate and apply knowledge of food science and food technology for optimal conservation and utilisation of the nation's food resources.
- Integrate scientific and technological knowledge into conventional systems
- Add value and utility to agro resources through research and development thereby, contributing to sustained development, food security and food safety.

A brief overview about the major food research institutes and explaining their specialization in respective food product domains is given in this chapter. An attempt has been made to cover various national institutes and summarizing food knowledge developed by them. This will benefit the user of this handbook in fetching the product information of beneficiary's interest and will also be able to know about new products and technologies developed which are ready for commercialization.

4.2 CFTRI

Central food Technological Research Institute (CFTRI) came into existence on October 21, 1950 as a constituent institute of Council of Scientific and Industrial Research (CSIR) as its third national laboratory. Located at Mysore, a cultural city of Southern India. CFTRI prides itself as the premier organization of scientific and industrial research in food science and technology in this part of the world.

Main Focus on CFTRI

Development of low cost and cost effective adaptable food technologies.
Utilization of indigenous raw material.
Bio friendly technology with emphasis on integrated processing.
High level pursuit of total technology.
Health and nutrition to the consumer.

FACILITIES CFTRI is equipped to address basic problems in understanding food system components i.e. (chemical, nutritional, toxicological, bio- molecular, biophysical, microbiological, physiological and sensorial profiling and food engineering) to evolve commercially viable processes and consumer friendly products.

CSIR- Central Food Technological Research Institute (CFTRI), Mysore (A constituent laboratory of Council of Scientific and Industrial Research, New Delhi) came into existence during 1950 with the great vision of its founders, and a network of inspiring as well as dedicated scientists who has a fascination to pursue in depth research and development in the areas of food science and technology.

Research areas:

Engineering Sciences
Technology Development
Translational Research
Food Protection and Safety

Website link: https://cftri.res.in/

Research Areas

Engineering Sciences | Technology Development | Translational Research | Food Protection & Safety | Center For Excellence

- Banana Bar
- Shelf Stable Muffins and Bread with Natural Preservatives
- Banana Pseudo Stem Beverage
- Gluten Free Bakery Products
- Carbonated Beverages
- Fish Gelatin and Wafers Egg Delicacies
- Osmo-Dried Fruits
  (Mango, Pineapple, Jackfruit and Amla)

Gluten is a storage protein of wheat. Gluten causes various health problems in sufferers of gluten-related disorders such as celiac disease, non-celiac gluten sensitivity, gluten ataxia, dermatitis herpetiformis and wheat allergy.

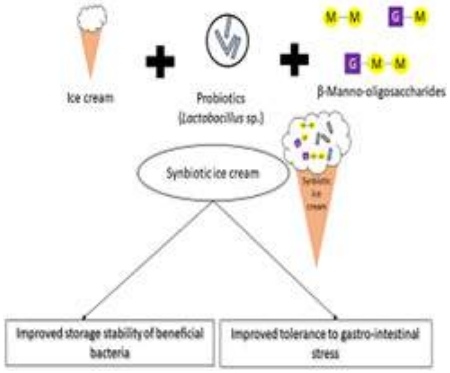
"Gluten-Free Diet" is a life-long treatment for gluten sensitive patients. In India, prevalence of rate of CD is around 1% which is more prevalent in the states of Punjab, Haryana, Delhi, Rajasthan and Uttar Pradesh. CFTRI developed various Gluten Free Bakery Products such as Gluten Free Cookies, Bread, Muffins and Biscuits to cater the need of CD patients.

Osmo-drying is a novel approach to get quality product with retention of good color and characteristics flavor. Due to osmosis process, there is a reduction in energy consumption in subsequent drying operations. The osmo-dried fruit segments are ready to eat (RTE) kind of product with good chew ability.

Translational Research

Low Fat Probiotic Ice Cream

Researchers at CSIR-Central Food Technological Research Institute have developed a low-fat synbiotic ice cream using β-manno-oligosaccharides (β-MOS), plant derived fibre as a prebiotic component and Lactobacillus plantarum and Lactobacillus fermentum as probiotics. β-MOS was used as it improved the counts of beneficial lactobacilli under harsh gastro-intestinal environment and to create many opportunities for new, innovative and healthy foods. The ice cream mix consisted of milk powder, sugar, fat, stabilizer, emulsifier, vanillin, milk with or without β-MOS / Fructo oligosaccharide (FOS) a prebiotic was used for comparison.



Probiotics Cold Coffee

Polyphenol enriched cold coffee containing viable count of >107 CFU/gm of a Lactobacillus pure culture is formulated. The composition and nutritional benefit of green coffee will be good for consumers.

CSIR – National Institute for Interdisciplinary Science and Technology (NIIST)
Council of Scientific & Industrial Research (CSIR), Ministry of Science and Technology, Govt of India .
Industrial Estate PO, Thiruvananthapuram, Kerala 695019

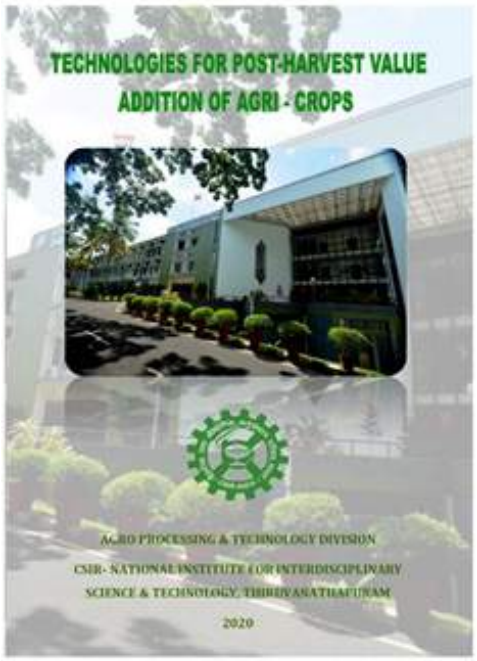
Home | About Us | Director | R&D Divisons | Support Division | Technologies | R&D Outputs | Business Dev | Academics | Key Contacts

Research Areas

› Agro Processing and Technology

Website link: https://www.niist.res.in/english/

Technologies/Know-how



1. Biodegradable cutleries, cups, glass and plates from agri wastes (wheat barn, sugar cane bagasse, rice husk, fruit peels and pineapple leaves)
2. Dehumidified drier for food / agri produces
3. Dehydrate fruits and fruit preserve in honey
4. Endophytic bacterial formulation – Plant Tonic
5. Fresh Ginger processing Technology
6. Functional vegetable oils based on Red palm olein (RPO) for culinary use with enriched carotenoids and optimum fatty acid profile
7. Instant breakfast products based on millets and ancient grains
8. Instant cereal based rice and wheat products
9. Process for preparation of White Pepper
10. Ready to cook Dehydrated vegetables/vegetable mixes
11. Ready to cook matured jackfruit bulbs
12. Ready to Cook tubers, starchy vegetables and pulses
13. Technology for Red palm olein (RPO) based soft gel as vitamin A supplement for combating vitamin A deficiency
14. Value added syrups from Palm neera and coconut neera

Dehydrated Raw Jackfruit

Banana Based Product

Jackfruit Preserved in Honey

Syrup from Palm Sap

4.3 DFRL

रक्षा अनुसंधान एवं विकास संगठन
DEFENCE RESEARCH & DEVELOPMENT ORGANISATION
Ministry of Defence, Government of India

Defence Food Research Laboratory (DFRL)

Lab Home | About Us | Director | Area of Work | Products/Technologies | Contact Us

Defense Food Research Laboratory (DFRL) is researching various aspects of food science and technologies such as the development of convenience foods, preservation of foods, nutritional and biochemical evaluation, foods safety, food packaging.

1. Research & Development of Advanced Food Technologies
2. Development of State-of-the art Food Packaging Technologies
3. Food support to Troops, Expeditions
4. To create Necessary Infrastructure & Test Facilities for R&D

Products / Technologies → Technologies →

Food additive technology
Accelerated freeze drying technology
Pneumatic drying technology
Flaking technology
Fluidised bed drying technology
Spray drying technology
Hurdle process technology

Products ↓


Food Test kits


Survival Ration

Website link: https://dfrl.org/

4.4 APEDA

एपीडा APEDA
AGRICULTURAL AND PROCESSED FOOD PRODUCTS EXPORT DEVELOPMENT AUTHORITY (APEDA)
(MINISTRY OF COMMERCE & INDUSTRY, GOVERNMENT OF INDIA)

हिंदी | RTI |

Corporate Info | General Info | APEDA Products | Schemes | Trade Information | Quality | WTO-SPS Secretariat | Statistics | Exporters

The agricultural and processed food products export development authority (APEDA) was established by the government of India under the agricultural and processed food products export development authority act passed by the parliament in December 1985 the act of 1988 came into effect from 13th February 1986 by a notification issued in the gazette of India extraordinary part – II 1968. The authority replaced the processed food export promotion council (PFEPC).

APEDA Products →

Floriculture & seeds	Fresh fruit and vegetables	Processed foods
Animal products	Cereals	Millets
Organic products	APEDA Product catalogue	

Website link: https://apeda.gov.in/apedawebsite/

4.5 MPEDA

MPEDA

The Marine Products Export Development Authority (MPEDA) was set up by an act of Parliament during 1972. The erstwhile Marine Products Export Promotion Council established by the Government of India in September 1961 was converged in to MPEDA on 24th August 1972. MPEDA is given the mandate to promote the marine products industry with special reference to exports from the country. It is envisaged that this organization would take all actions to develop and augment the resources required for promoting the exports of "all varieties of fishery products known commercially as shrimp, prawn, lobster, crab, fish, shell-fish, other aquatic animals or plants or part thereof and any other products which the authority may, by notification in the Gazette of India, declare to be marine products for the purposes of (the) Act". The Act empowers MPEDA to regulate exports of marine products and take all measures required for ensuring sustained, quality seafood exports from the country. MPEDA is given the authority to prescribe for itself any matters which the future might require for protecting and augmenting the seafood exports from the country. It is also empowered to carry out inspection of marine products, its raw material, fixing standards, specifications, and training as well as take all necessary steps for marketing the seafood overseas.

MPEDA SOCIETIES EXPORTS PRODUCTION SERVICES

LIST OF VALUE ADDED SEAFOOD ITEMS

Concept of Value Addition

Value addition is the enhancement added to a product or service by a company before the product is offered to customers.

Products processed as "Ready to eat', 'Ready to cook', 'Ready to fry', 'thaw & eat', ' Heat & Serve' and 'retail raw branded products' and other fishery pharmaceutical and cosmetic products of high unit value in export market are considered as Value Added Products.

A. Shrimp Products

1. Breaded And Battered Shrimp
2. IQF Marinated Shrimp
3. Skewered Shrimp
4. Stretched Shrimp (Nobashi)
5. AFD Shrimp, AFD Powder
6. Blanched/ Cooked Shrimp
7. IQF Head-On/ Headless /Butterfly cooked/ blanched shirimp
8. IQF Peeled Tail-on cooked shrimp
9. Cooked salad shrimp
10. Cooked and peeled shrimp
11. Sushi
12. Shrimp Pickle
13. IQF Tray pack shrimp
14. Shrimp Curry.

B. Cephalopods Products

1. Double Skinned Cuttlefish IQF Sashmi Grade
2. IQF Cooked/ Blanched squid Cuttlefish fillets Sashimi grade
3. Cuttlefish strips blanched
4. Squid strips blanched
5. Cuttlefish Pine Cut/ Diamond Cut
6. Stuffed Squid IQF Tray Pack
7. Squid Tube Tray Pack
8. Squid Ring Blanched IQF
9. IQF Tray Pack Squid
10. Cuttlefish Skewers
11. Vaccum Skin Packed Squid & Cuttle Fish Products in trays
12. Marinated Squid
13. Battered and breaded Cephalopod products
14. AFD Cuttlefish/Squid.

C. Finfish products

1. Fish pickles
2. Fish curry Frozen Fish Fillets
3. Fish Loins/ Fish Steaks
4. Breaded fish fingers
5. Breaded fish fillets
6. Tray pack fish
7. Pre-cooked Loins
8. Fish powder
9. Fish soup

D. Other items

1. Pasteurized crab meat
2. Stuffed crab (crab balls/ saicie)
3. Seafood and vegetable mix
4. Mixed seafood skewers
5. Seafood mix in tray pack
6. Surimi Analogue products
7. Patties/nuggets
8. Mussels/Clam meat pickle
9. Crab cakes
10. Breaded crab cakes
11. Raw crab meat
12. Paddle crab in trays
13. Half cut cooked lobster
14. IQF/Tray packed peeled lobster meat
15. Seafood sausage
16. Frozen seafood curry and rice
17. Frozen seafood curry with porotta
18. Blanched/cooked lobster tail
19. Seafood in brine/ oil/ sauce
20. Fried bivalves/ fish/ shrimp

4.6 NIN

National institute of nutrition (NIN) was founded by sir Robert McCarrison in the year 1918 as 'Beri-Beri' Enquiry Unit in a single room laboratory at the Pasteur Institute, Coonoor, Tamil Nadu. Within a short span of seven years, this unit blossomed into a 'Deficiency Disease Enquiry' and later in 1928, emerged as full- fledged 'Nutrition Research Laboratories' (NRL) with Dr. McCarrison as its first Director. It was shifted to Hyderabad in 1958. At the time of its golden jubilee in 1969. It was renamed as national institute of nutrition (NIN).

NIN has attained global recognition for its pioneering studies on various aspects of nutrition research, with special reference to protein energy malnutrition (PEM). Institute's activities are broad-based, encompassing the whole area of food and nutrition. The Institute has achieved close integration in its research activities between the laboratory, the clinic and the community. The Institute has been recognized by many national and international agencies as Centre for conducting advanced as well as ad-hoc training courses in nutrition and laboratory animal sciences. It possesses sophisticated equipment and swell-equipped modern facilities and for clinical, laboratory and community based research.

Website link: https://www.nin.res.in/

Books Released by NIN

4.7 IIP

The Indian Institute of Packaging (IIP) is a national apex body which was set up in 1966 by the packaging and allied industries and the Ministry of Commerce, Government of India, with the specific objective of improving the packaging standards in the country. The Institute is an autonomous body working under the administrative control of the Ministry of Commerce.

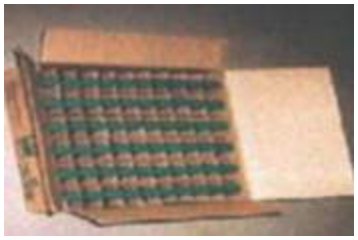
Major research & development projects

Packaging of cashew kernels for exports
Packaging of meat, meat products and poultry
Packaging of Indian sweet
Packaging of fresh grapes
Packaging of banana chips
All India study on packaging of processed foods
Development of packaging specifications for whole, ground spices
Packaging of fresh fruits and vegetables
Packaging of extruded foods
Packaging of frozen pre-cut fruits and vegetables for exports
Packaging of jeera puris
Packaging of honey
Packaging of onions for exports
Packaging of boondi laddus
Upgradation of sea food packaging
Packaging of rabdi
Packaging of dried fish
Packaging of dudhi halwa
Development of export packaging specifications for guar gum
Packaging of fresh fruits & vegetables for exports
Development of export packs for dehydrated/ freeze dried vegetable
Packaging of coconut chips
Packaging of ball & cup copra

Packaging Design and Development Work

Development of Transport Pack for export of Bananas

Packaging of Drinking Water



Packaging of Hair Oil in PET Bottle

4.8 ICAR INSTITUTES

Introduction

ICAR is an autonomous body responsible for coordinating agricultural education and research in India. ICAR comes under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. The ICAR has its headquarters at New Delhi. The Council is the apex body for coordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country and with 101 ICAR institutes and 71 agricultural universities spread across the country. This is one of the largest national agricultural system in the world.

The Minister for Agriculture is the president of the ICAR. Its principal executive officer is the Director General. He is secretary to the Government of India in the Department of Agricultural Research and Education. Its members include the minister of Agriculture, Animal Husbandry and fisheries and senior officers of the various state governments, representatives of the parliament. The agro industries, scientific organizations and farmers.

The Governing Body is the chief executive and decision making authority of the ICAR. It is headed by the Director General. It consists of eminent agricultural scientists, educationists, legislators and representatives of farmers. It is assisted by the standing Finance Committee, Accreditation Board, Regional Committees and several scientific panels.

Functions

The ICAR is one of the important organisation at national as well as at international level. To plan, undertake, aid, promote and coordinate education, research and its application in agriculture, animal science, fisheries, agro-forestry and allied sciences. To act as clearing house for research and general information relating to agriculture, animal husbandry, fishery, agroforestry, home science and allied sciences through its publications and information system and instituting and promoting transfer of technology programmes and Societies Registration Act, 1860 in pursuance of the report of the Royal Commission on Agriculture. To provide, undertake and promote consultancy services in the field of research, education, training and dissemination of information in agriculture, animal science, fisheries, agroforestry, home science and other allied sciences. To look the problems relating to broader areas of rural development concerning agriculture, including post harvest technology by developing cooperative programmes with other organisations such as the Indian council of social Science Research, Council of Scientific and Industrial Research, Bhaba Atomic Research Centre, state Agricultural Universities etc. The vast network of ICAR includes Institutes, Bureaux, National Research Centres & Project Directorates.

List of ICAR Research Institutes

ICAR Institutions, Deemed Universities, National Research Centres, National Bureaux & Directorate/Project Directorates

Deemed Universities - 4

1.	ICAR-Indian Agricultural Research Institute, New Delhi
2.	ICAR-National Dairy Research Institute, Karnal
3.	ICAR-Indian Veterinary Research Institute, Izatnagar
4.	ICAR-Central Institute on Fisheries Education, Mumbai

Institutions - 65

1.	ICAR-Central Island Agricultural Research Institute , Port Blair
2.	ICAR-Central Arid Zone Research Institute, Jodhpur
3.	ICAR-Central Avian Research Institute, Izatnagar
4.	ICAR-Central Inland Fisheries Research Institute, Barrackpore
5.	ICAR-Central Institute Brackishwater Aquaculture, Chennai
6.	ICAR-Central Institute for Research on Buffaloes, Hissar
7.	ICAR-Central Institute for Research on Goats, Makhdoom
8.	ICAR-Central Institute of Agricultural Engineering, Bhopal
9.	ICAR-Central Institute for Arid Horticulture, Bikaner
10.	ICAR-Central Institute of Cotton Research, Nagpur
11.	ICAR-Central Institute of Fisheries Technology, Cochin
12.	ICAR-Central Institute of Freshwater Aquaculture, Bhubneshwar
13.	ICAR-Central Institute of Research on Cotton Technology, Mumbai
14.	ICAR-Central Institute of Sub Tropical Horticulture, Lucknow
15.	ICAR-Central Institute of Temperate Horticulture, Srinagar
16.	ICAR-Central Institute on Post harvest Engineering and Technology, Ludhiana
17.	ICAR-Central Marine Fisheries Research Institute, Kochi
18.	ICAR-Central Plantation Crops Research Institute, Kasargod
19.	ICAR-Central Potato Research Institute, Shimla
20.	ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore
21.	ICAR-Central Research Institute of Dryland Agriculture, Hyderabad
22.	ICAR-National Rice Research Institute, Cuttack
23.	ICAR-Central Sheep and Wool Research Institute, Avikanagar, Rajasthan
24.	ICAR- Indian Institute of Soil and Water Conservation, Dehradun
25.	ICAR-Central Soil Salinity Research Institute, Karnal
26.	ICAR-Central Tobacco Research Institute, Rajahmundry
27.	ICAR-Central Tuber Crops Research Institute, Trivandrum

4.8.1 NDRI, Karnal

ICAR-National Dairy Research Institute (NDRI) at Karnal, Haryana is one of the premier Institutes in dairy sector, which has contributed a lot in the growth of dairy industry and played a crucial role in India's development in milk production with its continuous research. Over ninety-six-year-old NDRI's lineage goes back to the Imperial Institute for Animal Husbandry & Dairying which was set up in Bangalore in 1923 as a centre for dairy education.

Home → About NDRI → Research

Website link: https://ndri.res.in/technologie

Technologies Commercialized

S. No	Name of technology
1.	Low-cholesterol Ghee
2.	A new test for detergent detection for milk
3.	Mineral mixture
4.	Detection of L. monocytogenes in Milk
5.	High protein Iron fortified Bajra Biscuits
6.	Bajra Lassi
7.	An indigenous probiotic strain of Lactobacillus fermentum Technology
8.	An indigenous probiotic strain of Lactobacillus plantarum Technology
9.	Nutrimix
10.	EPS producing culture for preparation of low-fat dahi
11.	Whey Jaljeera
12.	Bioprocess for Direct Vat Set (DVS) Misti Dahi


Low-cholesterol Ghee


Bajra Lassi

Bajra Biscuits

4.8.2 IIMR, Hyderabad

भारतीय कदन्न अनुसंधान संस्थान
Indian Institute of Millets Research

Home | About Us | Payment Gateway (Thru'SBIePay) | Research & Projects | Awards & Recognitions | Press Release | Trainings / Seminars | AICRP

ICAR- Indian Institute of Millets Research (IIMR), the host institution, is the nodal to work on all aspects of millets research and development in the country under the suspices of Indian Council of Agricultural Research (ICAR). It was established at Hyderabad in 1958. It has conducted extensive research on all aspects of crop improvement, production, protection and promotion including millet value chain from farm to fork agri – input to end use consumption.

Research & Projects

Website link: https://www.millets.res.in/m_recipes.php

NEW TECHNOLOGIES ON MILLET VALUE ADDED FOODS

1. Puffs from Sorghum
2. Extruded Snacks
3. Millets Bread/Bun
4. Millet Cake
5. Millets Cookies
6. Extruded Flakes
7. Instant Sorghum Idli Mix
8. Millet Vermicelli
9. Instant Upma Mix
10. Millets Pasta
11. Millet Flour

Sorghum puffs are RTE (ready to eat) snacks which are developed using puff gun machine where the sorghum grain is loaded into a rotating barrel and fired resulting in an expanded product to a maximum expansion consistent with retention of the grain identity.

Products and by products: Puffs yield – 94%: By – product yield – 6% (small puffs and unpuffed grains)

Advantages and Uniqueness of technology/Product

They are rich in protein and fibre

Variants available masala coated and fried, and also can be coated with other flours and fried.

The shelf life is for 4 months when packed in air tight MET pouches at ambient temperatures

It can serve as inflight snack or generic evening snack.

Millet Recipes

4.8.3 IIHR, Bangalore

The Institute spread its sphere of Research activities to the length and breath of the nation by establishing its experimental stations at Lucknow, Nagpur, Ranchi, Godhra and Gonikal over the year these experiment stations have grown in size and today they stand as independent institutes, however, relating the chettalli and Gonikapal under its fold. As of now, the IIHR has its man=in research station at Hessaraghatta, Bangalore with 263 ha of land and Regional experiment station at Bhubaneshwar in Orissa with two Krishi Vigyan Kendras both located in Karnataka state at Gonikopal in Kondagu in Tumkur districts. Apart from this, the Project coordinating cell of the all India coordinated research project on fruit is also located at the institute at Bangalore.

Varieties / Technologies released by ICAR - IIHR

Website link: https://iihr.res.in/technologies

Sl. No.	Technologies
1	Arka Mushroom Millet Cookies
2	Nutrient management for Dendrobium orchid cultivation
3	Arka Cucurlure
4	Arka Iron Fortified Mushroom
5	Arka Sasya Poshak Ras: A Liquid Nutrient Formulation for Soilless Vegetable Production
6	Arka Haagalarasa: Ready -to-serve (RTS) Bitter gourd Juice
7	Arka Virus Kit: tomato leaf curl Bangalore virus (ToLCBV) LAMP detection kit
8	Probiotic RTS Mango Beverage
9	Probiotic Pomegranate Juice
10	Pomegranate Aril Extractor
11	Solar Power Operated Tricycle Cart for vending Ready to Harvest Fresh Mushroom
12	Solar Power Operated Tricycle Cart for Fresh Fruits and Vegetables Vending
13	Arka Jackies
14	Arka Jacholate
15	Arka Halasuras

Jackfruit seed powder and mushroom based chocolate developed by ICAR-IIHR, Bengaluru. Seeds constitute 12-23% of a fresh jackfruit, which is thrown away as waste. Jackfruit seed contains 60-65% starch (RS-Type-2), 2% crude fibre and an array of phytochemicals reported to have antibiotic and anti-cancerous properties. A technology has been developed to deliver such a wonderful natural product to the body through chocolate, which is most liked by all age groups. The technology comprises of packaging jackfruit seed powder with several other natural ingredients like mushroom, sesame, butter, etc., in certain a proportion and wrapping it with chocolate. The product is highly tasty and nutritious with 5.0-6.0% protein, lesser fat and calorific value, higher fibre and antioxidant activity.

4.8.4 CPRI, Shimla

भाकृअनुप - केन्द्रीय आलू अनुसंधान संस्थान, शिमला
ICAR-Central Potato Research Institute,Shimla

About Us - Research - Divisions - Regional Stations - Publication - Web Resources - Payment Gateway RTI - Contact Us

Indian Council of Agricultural Research (ICAR)-Central Potato Research Institute (CPRI) was established during August 1949 at Patna (Bihar, India) on the recommendation of the Agricultural Advisor to the Government of India, Sir Herbert Steward under the Ministry of Agriculture and Farmers Welfare, Government of India. The institute was later on, shifted to Shimla, Himachal Pradesh in 1956 in order to facilitate hybridization work in potato breeding and maintain seed potato health. It was transferred to the ICAR in April 1966.

About Us - Research -

Website link: https://cpri.icar.gov.in/

Commercial Technologies

S. No	Process Developed
1.	Dehydration of Tubers
2.	Potato Based Gluten-Free Cookies
3.	Potato Daliya/Porridge, Semolina And Flour
4.	Storage Of Processing Potatoes At10-12°C
5.	Processing Of Potatoes Into Chips, French Fries And Other Products
6.	11 Potato Varieties Released
7.	Potato Custard Powder
8.	Genetically Modified Potato With Reduced Level Of Reducing Sugars
9.	Hi–Tech Seed Production Through Micro propagation
10.	Aeroponic Technology
11.	Modular Structure For Covering An Area With A Net
12.	In Vitro Plant Acclimatization
13.	Device For Hydroponic Culture Of Plants

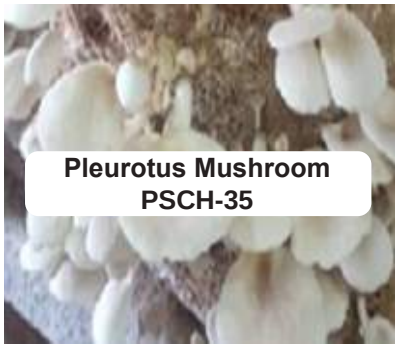
4.8.5 DMR, Solan

ICAR-Directorate of Mushroom Research is located in Solan city of Himachal Pradesh, endeared as the gateway of Himachal Pradesh, the mountainous wonder of Solan city is famous for its cultural splendor, excellent picnic spots, numerous old temples and seasonal vegetable crops. Being quite industrialized, Solan is widely popular for its mushroom cultivation and bearing the title of "Mushroom City of India".

Technologies commercialized

Website link: https://dmrsolan.icar.gov.in/

Released strains of temperature tolerant white button mushroom (A.bitorquis): Two improved strains of summer white button mushroom (Agaricus bitorquis) viz; NCB-6 and NCB-13 were released along with complete package of practices in form of 2 booklets during the VIII AICMIP Workshop held at NRCM, Solan from 1-2 May, 2000. The new varieties are introduction from hot areas of USA and were released for commercial cultivation in India after evaluation trials and standardization of cultivation technology for 6-7 years at this Centre.



Title of the Technology: Binding agents in mushrooms for development of meat analogues - click here

Title of the Technology: Mushroom fortified millet cookies - click here

Title of the Technology: Mushroom fortified instant noodles for better quality and nutritive value - click here

Title of the Technology: Mushroom millets Nutri-bar - click here

Title of the Technology: Management of Wet Bubble Disease (WBD) using understanding of its pathogenesis in Button Mushroom - click here

Easy, Reliable and Safe Substrate Sterilization Technique for Oyster Mushroom

Website link: https://dmrsolan.icar.gov.in/html/technologycommercialized.html

4.8.6 IISR, Kerala

ICAR-Indian Institute of Spices Research
(Indian Council of Agricultural Research)
Kozhikode-673012, Kerala, India

Home | About IISR | Research | Services | Publications | Education | Farmer's Corner | Facilities | Online payment | Online Store

A major step in initiation of sustained research on spices was the launching of All India Coordinated Spices and Cashew Improvement Project (AICSCIP) at Central Plantation Crops Research Institute (CPCRI) at Kasaragod, Kerala during 1971 by Indian Council of Agricultural Research (ICAR). Later the ICAR felt the need for intensifying research on spices and established a Regional Station of CPRCRI at Kozhikode, Kerala during 1975, exclusively for conducting research on spices by the ICAR.

Research Achievement – Technology Developed

Website link: http://www.spices.res.in/

S. No	Name of technology developed
1.	Zero Energy Chamber
2.	Arecanut + Chaba Intercropping
3.	Drip irrigation schedule for brush pepper
4.	Mechanical Thresher for black pepper
5.	Blanching and drying of mace
6.	Integrated nutrient input technology for black pepper
7.	Low input nutrient technology for black pepper

Mace, after separation from the kernel was spread in a single layer over the wire-mesh –bottom drying chamber. Hot air drying of mace required 4 h to complete drying. The weight reduction was higher during the initial phases of drying, which then decreased subsequently.

Varieties Developed

Pepper Varieties

Cardamom Varieties

Ginger Varieties

Turmeric Varieties

Cinnamon Varieties

Nutmeg Varieties

4.8.7 CIFT, Cochin

Indian Council of Agricultural Research - CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY
भारतीय कृषि अनुसंधान परिषद - केन्द्रीय मात्स्यिकी प्रौद्योगिकी संस्थान
(ISO/IEC 17025:2017 NABL Accredited & ISO 9001:2015 certified)

ABOUT US | DIVISIONS | TECHNOLOGIES | RESEARCH CENTRES | PROJECTS | SERVICES | FACILITIES | PUBLICATIONS | TENDERS | SITEMAP

The ICAR - Central Institute of Fisheries Technology (ICAR-CIFT) set up in 1957 is the only national centre in the country where research in all disciplines relating to fishing and fish processing is undertaken. The institute started functioning at Cochin in 1957.

Functions

- Basic and strategic research in fishing and processing.
- Design and development of energy efficient fishing systems for responsible fishing and sustainable management
- Development of implements and machinery for fishing and fish processing.

Technology & Products

Website link: https://www.cift.res.in/

Glucosamine hydrochloride

Glucosamine hydrochloride is a popular supplemental form of the joint nutrient glucosamine. Glucosamine is the most important building block of joint cartilage. CIFT has developed a method for preparation of glucosamine from the shells of shrimp

Fish kure

Fish Kure is a fish based extruded food product and have application as snack food. Usually, extruded products are prepared using cereal flour, which have less protein content and are limited in some essential amino acid. By incorporating protein-ric

Fish curry in retortable pouches

Value addition and diversification to satisfy the ever changing and diverse demands from the importing countries as well as urban consumers at home are some of the major challenges faced by Indian processing industry.

Battered and breaded products

Value added product is preferred by the consumer for its convenience and it's ready to use nature. It also provides better return and increased profits to the entrepreneurs.

Smoked Masmin Flakes

An innovative value added product has been developed using a new processing method by smoking and drying skip jack tuna meat which is similar to the commercially available masmin flakes.

Coated Fish Products

Coated product is one, which is coated with another foodstuff. Two types of coatings are in common use. They are batter and breadcrumbs.

4.8.8 CIAE, Bhopal

The vision of ICAR-CIAE, Bhopal is "to modernize Indian agriculture by improvement in crop productivity through agricultural mechanization, harnessing energy from renewable sources, efficient management of irrigation water, reduction in post-harvest losses and promote agri-business with a view to enhance income and generate employment in rural sector".

The Institute has 93.85 ha land for research, office and residential purpose. The Research Workshop provides the facilities for fabrication of research prototypes and the Prototype Production Centre multiply research prototypes for multi-locational trials.

TECHNOLOGIES

Website link: https://ciae.icar.gov.in/

Food Processing and Post Harvest

- Bio Oil Production Unit
- Millet Mill
- Millet flaking machine
- Fruit/vegetable graders
- Aloevera whole gel extraction equipment
- Mechanization Packages for Banana pseudo stem
- Soy Butter
- Pilot scale modified atmosphere storage (MAS) system
- PLA based biodegradable films
- Automated packing line for spherical horticultural produce
- Sugarcane rind removing equipment for juice making

Manual grading of fruits and vegetables is tedious and to reduce drudgery and improve efficiency ICAR-CIAE has developed fruit/ vegetable graders of varying capacity suitable for grading of fruits and vegetables such as apple, guava, mango, sapota, citrus, tomato, onion, potato, walnut etc. Capacity of these machines are 1 and 5 t/h, respectively.

Soy-butter is healthy, nutritionally rich; cholesterol and trans - fat free plant based spread with high protein content of 39 % making it ideal for people who are suffering from protein malnutrition, obesity and hypercholesterolemia. It has no added flavour and preservatives with a shelf life 3 months under ambient conditions.

4.8.9 NRC-Meat, Hyderabad

ICAR-National Research Centre on Meat
भाकृअनुप - राष्ट्रीय मांस अनुसंधान केंद्र
(ISO/IEC 17025:2017 NABL accredited & ISO 9001:2015 certified)

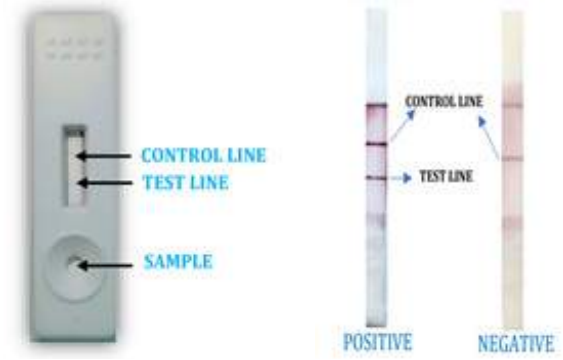
Home | About NRCM | Publications | Achievements | ICAR eOffice | Payment GateWay

The importance of developing Indian meat sector towards an efficient and organized activity to utilize livestock resources to provide meat and by-products of human utility to the growing population needs has been realized. With this challenging backdrop, Indian Council of Agricultural Research has visualized the need for establishing an exclusive research centre on meat. National Research Centre on Meat was initiated at IVRI campus, Izatnagar in the year 1986 and later shifted to Hyderabad in the year of 1999.

Technology

Website link: https://nrcmeat.icar.gov.in/aboutus.aspx

Pork Identification Technology



Traditional analytical methods for identifying meat fraud require specially equipped stationary laboratories, high-tech equipment, and qualified personnel. The simple, rapid, low-cost, highly specific and sensitive lateral flow immunoassay (LFIA) can be a complemented to stationary arbitration methods in resource-limited settings. This kit is a qualitative sandwich immune-chromatographic test in a strip format to determine pork content in raw meat, processed meat and meat mixes.

MEAT PROCESSING PLANT

A well-equipped meat processing is established to organize entrepreneurship trainings for small and medium scale entrepreneurs, cater facilities to the entrepreneurs for developing their business and preparation of meat and meat products for revenue generation of the Centre. The facility is provided with all the equipments for preparation of ground, emulsion, restructured, enrobed, traditional and other functional meat products along with cold storage facilities.

4.8.10 NRC-Banana, Tiruchirappalli

Home | About NRCB | Research | Publications | Farmers | Services | Downloads | Facilities | ICAR Links | FAQ's | Contact Us | Online Payment

ICAR- National Research Centre for Banana was established on 21st August 1993 at Tiruchirappalli, Tamil Nadu by ICAR, New Delhi with an aim to increase the production and productivity of banana and plantains through mission mode basic and strategic research approaches. The Centre works on four major thrust areas of research viz., Crop improvement, Crop production, Post harvest management and Crop protection. It has well-equipped laboratories for tissue- culture, bio-technology, soil science, nutrient management, physiology, biochemistry, entomology nematology, fungal, bacterial, viral pathology and post harvest technology research.

Home | About NRCB | Research

Website Link: https://nrcb.icar.gov.in/about-us.php

Varieties Developed →

Udhayam Kaveri Kalki (Namwa Khom)	Kaveri Sugantham Kaveri Haritha	Kaveri Saba

Technologies Developed → **Post-harvest Technology**

Fresh Produce	
Pre and Post harvest protocol of Ney Poovan and Red Banana for export	
Standardization of ripening agent for better ripening and sensory parameter of banana	
Processed products using green banana	Processed products using ripe banana
Minimal Processing of Cut Banana Slices	Dehydrated ripe banana(banana fig)/glazed ripe banana
Low fat, flavoured banana chips	Cost effective ripe banana powder
Standardization of pre-treatments and drying condition for banana flour	Banana sauce,sweet chutney
Banana flour production and related value added products	Ready to serve banana drink
Flour based weaning food, health drinks	Cost effective juice clarification methods
Extraction of starch from Banana	Fortified basil seed suspended banana juice
Process for modification of starch	Fortified banana nutri-bars
Low Glycemic, Gluten free products using banana flour	Chilled banana sip-up

4.9 Coconut Development Board, Kochi

Coconut Development Board
Ministry of Agriculture and Farmers Welfare, Government of India

About CDB | Schemes | Health Benefits | Cultivation | Staff Corner | Download | Tenders | Vacancy | Contact Us

Coconut Development Board (CDB), is a statutory body established under the Ministry of Agriculture and Farmer Welfare, Government of India for the integrated development of coconut cultivation and industry in the country with focus on productivity increase and product diversification.

Function of the Board

- Adopting measures for the development of coconut industry
- Imparting technical advice to those engaged in coconut cultivation and industry
- Providing financial and other assistance for the expansion of area under coconut
- Encouraging adoption of modern technologies for processing of coconut and its products.

About CDB | Schemes | Health Benefits

Website Link: http://www.coconutboard.gov.in/

Tender coconut water	Coconut	Coconut Oil	Virgin Coconut Oil	Neera / Coconut sugar

Coconut Products


Coconut Milk


Coconut Chips


Coconut Oil


Coconut Palm Sugar


Coconut Burfi


Coconut Flower Syrup


Tender Coconut Water

4.10 Tea Board of India

Tea is one of the industries, which by an Act of Parliament comes under the control of the Union Govt. The present Tea Board is functioning as a statutory body of the Central Government under the Ministry of Commerce. The Board is constituted of 31 members (including Chairman) drawn from Members of Parliament, tea producers, tea traders, tea brokers, consumers, and representatives of Governments from the principal tea producing states, and trade unions.

Website link: https://www.teaboard.gov.in/home

Varieties of Tea

- Darjeeling
- Assam
- Nilgiri
- Kangra
- Dooars-Terai
- Masala Tea
- Sikkim Tea
- Tripura

Darjeeling

Assam

Nilgiri

Kangra

Dooars-Terai

Sikkim

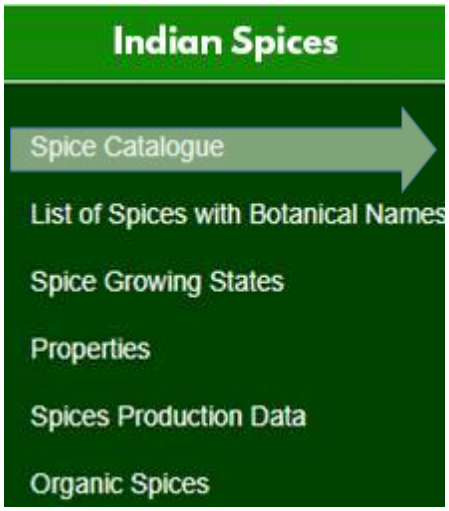
4.11 Spice Board of India

Spices Board (Ministry of Commerce and Industry, Government of India) is the flagship organization for the development and worldwide promotion of Indian spices. The Board is an international link between the Indian exporters and the importers abroad. The Board has been spearheading activities for excellence of Indian spices, involving every segment of the industry. The Board has made quality and hygiene the corner stones for its development and promotional strategies.

Main Functions

- Research and Development
- Post – harvest improvement of all spices
- Promotion of organic production
- Development of spices in the North East
- Provision of quality evaluation services

Website link: http://www.indianspices.com/index.html



Ginger | Turmeric | Cumin | Chilli | Pepper | Cardamom

Recently released varieties of Small Cardamom

Post Harvest Technology for Large Cardamom

4.12 National Honey Board

The story of honey is older than history itself an 8,000- year- old cave painting in spin depicts honey harvesting, and we know it's been used for food, medicine and move by culture all over the world since. But honey is not about humans. It's the natural product made by bees-one of our most important animals. Honey bees visit millions of blossoms in their lifetimes, making pollination of plants possible and collecting nector to bring back to the hive. Lucky for us bees make more honey than their colony needs, and beekeepers removes the excess and bottle it. Just like they have been doing since the beginning of time.

Recipes Developed

- **Chewy honey oatmeal cookies**
- **Honey cough syrup**
- **Glazed pear martini**
- **Shaken honey matcha latte kale**
- **Salted honey macchiato**
- **Honey cucumber salad**
- **Crunchy honey**
- **Honey simple syrup**
- **Honey gingerbread cookies**
- **Honey strawberry**
- **A honey of a chili**
- **Honey chia seed pudding**
- **Honey oatmeal cookies**
- **Homemade honey ice-cream master recipe**
- **Sweet broccoli and asparagus**
- **Raspberry lime fizz**
- **Infused honey simple syrup**
- **Honey raspberry sweet tea**
- **Honey laches French toast**
- **Sweet & spicy honey popcorn**
- **Honey lemon bars**
- **Pineapple honey glazed ham**
- **Honey coconut nut bar**
- **Honey baked chicken**





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PM Formalisation of Micro food processing Enterprises Scheme

contact us

Director

National Institute of Food Technology, Entrepreneurship and Management, Thanjavur (NIFTEM-T)

Ministry of Food Processing Industries, Government of India,
Pudukkottai Road, Thanjavur - 613 005,
Tamil Nadu, India.

Phone No.: +91-4362 - 228155 | Fax No.:+91 - 4362 - 227971
Email: director@iifpt.edu.in | Web: www. niftem-t.ac.in