BHARATHIDASAN UNIVERSITY TIRUCHIRAPPALI-620 024 TAMIL NADU,INDIA

Programme : M.Sc., Biochemistry

Course Title : Value Addition in food Couse Code :BC003VAC

UNIT-V

MEAT FISH AND POULTRY PRODUCTS

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UNIT V

MEAT AND POULTRY

MEAT AND POULTRY

- **Meat** generally refers to the flesh of mammals, such as beef (from cattle), pork (from pigs), lamb (from sheep), and veal (from young cattle).
- **Poultry** refers to domesticated birds raised for their meat, such as chickens, turkeys, ducks, and geese.

PRESERVATION

Curing

Curing is the process of preserving food by adding salt, sugar, nitrates, or nitrites. It can be done through:

- **Dry curing**: Rubbing the curing mixture directly onto the meat.
- **Wet curing (brining)**: Soaking the meat in a solution of salt and water.

SMOKING

Smoking involves exposing food to smoke from burning wood or other organic materials.

It can be used alone or in combination with curing.

Common smoked products include smoked salmon, bacon

Freezing

- Freezing is one of the most straightforward preservation methods, lowering the temperature to inhibit bacterial growth.
- It retains the nutritional value of meat and poultry without the need for additives.

Canning

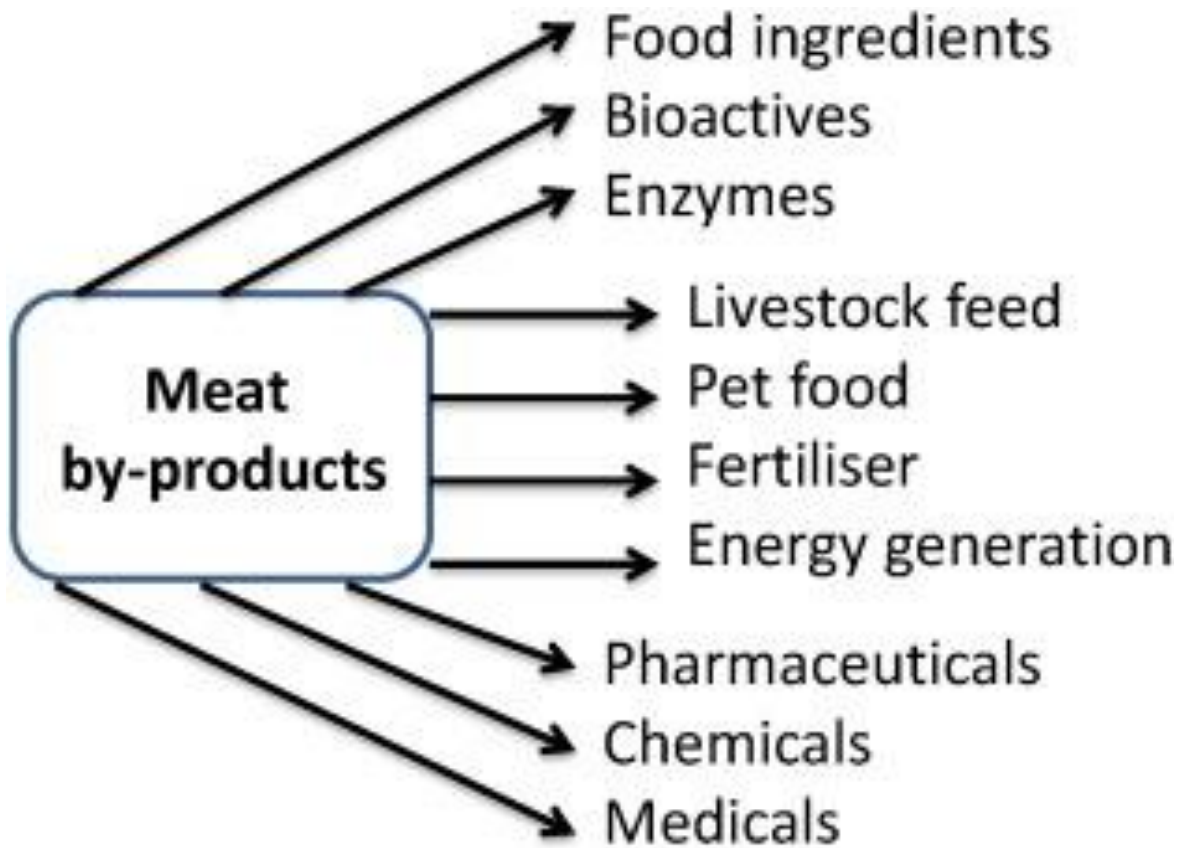
- Canning involves placing food in airtight containers (usually jars or cans) and heating them to destroy harmful bacteria and enzymes. There are two main methods:
- **Water bath canning**: For high-acid foods (e.g., fruits, pickles).
- **Pressure canning**: For low-acid foods like meats and vegetables, to prevent botulism.

Dehydration

- Dehydration removes water from food, preventing bacterial growth. It can be done using:
- **Sun drying**: Traditional method for foods like fish
- **Oven or electric dehydrators**: Control temperature for consistent drying.

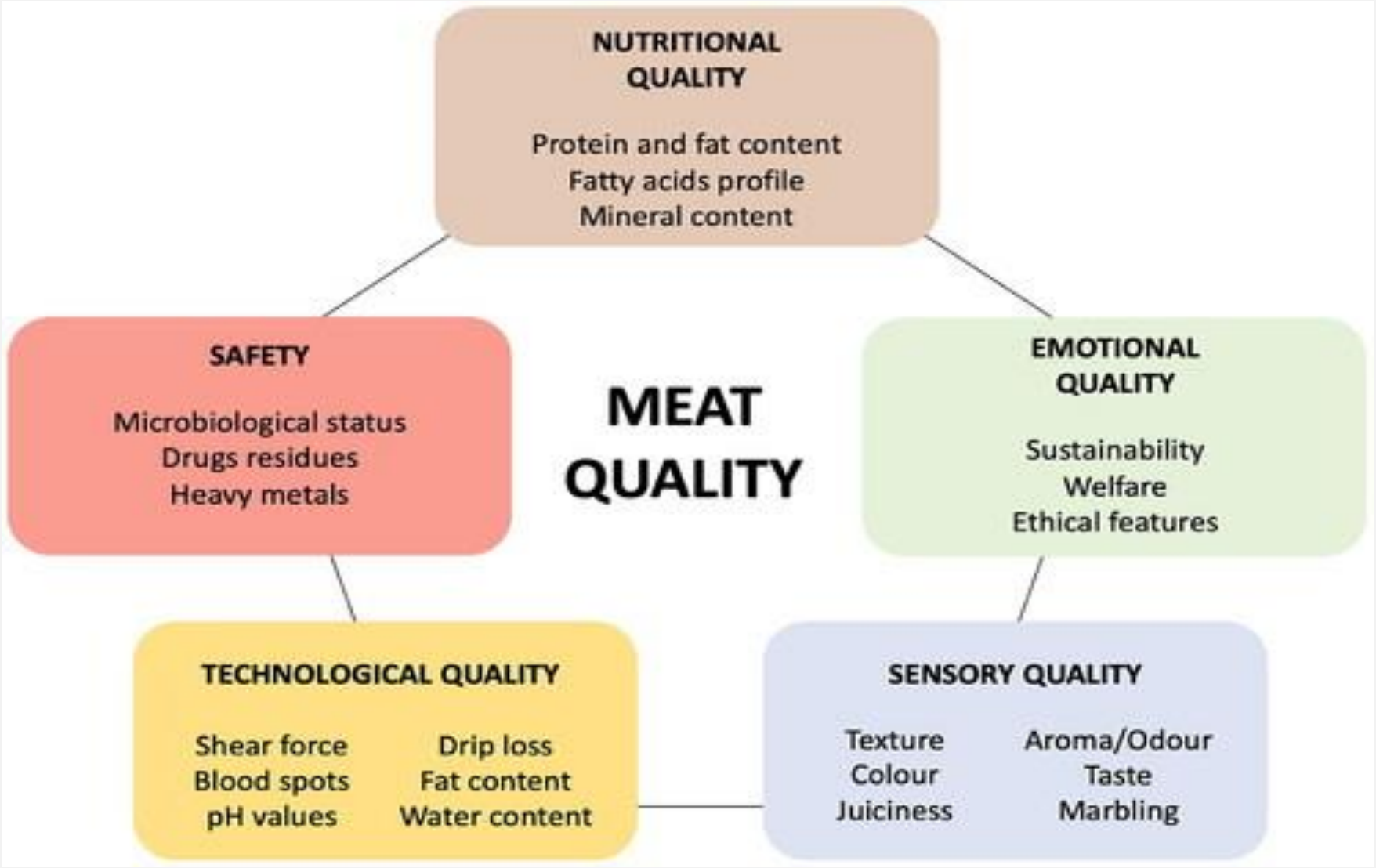
BYPRODUCTS

- Edible By-products- Offal, blood ,fat,Bones
- Leather production
- **Pharmaceutical Industry**: heparin,enzymes,insulin
- **Biodiesel Production-**Animal fats (especially tallow and lard) can be processed into **biodiesel**, a renewable energy source
- In cosmetics: It is used in anti-aging creams, hair care products, and skincare due to its collagen content.


Meat by-products
Food ingredients
Bioactives
Enzymes
Livestock feed
Pet food
Fertiliser
Energy generation
Pharmaceuticals
Chemicals
Medicals

MEAT FISH AND POLULTRY PRODUCTS

FACTORS INFLUENCING KEEPING QUALITY OF MEAT. PROCESSING AND PRESERVATION OF FISH AND ITS PRODUCTS


NUTRITIONAL QUALITY
Protein and fat content
Fatty acids profile
Mineral content
SAFETY
Microbiological status
Drugs residues
Heavy metals
MEAT QUALITY
EMOTIONAL QUALITY
Sustainability
Welfare
Ethical features
TECHNOLOGICAL QUALITY
Shear force
Blood spots
pH values
Drip loss
Fat content
Water content
SENSORY QUALITY
Texture
Colour
Juiciness
Aroma/Odour
Taste
Marbling

QUALITY OF MEAT

- **Meat quality be evaluated according to the following parameters: pH, amount of lactic acid, volatile fatty acids, bounded water, solubility of proteins, color, and tenderness.**
- **The meat composition and physical properties of muscles have been characterized for ensuring improved eating quality**
- **Eating quality parameters include colour (appearance), texture and tenderness, juiciness and flavour/odour of meat.**

Meat Quality

Functional quality
(including yield and
carcass composition)
-pH
-Colour
-Water holding capacity (WHC)

Eating quality
(Palatability factors)

Wholesomeness
-Microbiological quality
-Chemical quality
-Nutritional quality

FUNCTION QUALITY

- pH LEVEL
- COLOUR
- WATER HOLTING CAPACITY (WHC)

pH Level

- **The pH of meat influences its microbial stability.**
- **Meat with a lower pH (around 5.3–5.5) is more resistant to microbial growth.**
- **Postmortem glycolysis leads to a decline in pH as glycogen is converted to lactic acid, which affects keeping quality.**

COLOUR

- **Intrinsic to the Muscle**
- **Color and stability of the meat color are influenced by pigment concentration, and by cellular level reactions involving oxidation, reduction, and oxygenation of the color pigments.**

WATER HOLTING CAPACITY (WHC)

- **WHC is a critical factor in determining the quality of meat, affecting its visual appearance, juiciness, and tenderness.**
- **Meat with poor WHC can be dry and have high drip loss, which can lead to significant weight loss and affect the yield and quality of processed meats.**

EATING QUALITY

Animal Genetics and Breed

- **Genetic traits can influence muscle fiber type and fat deposition, impacting the overall eating experience.**

Diet and Nutrition

- **Like antioxidants, can improve flavor and prevent oxidation of fats.**

Intramuscular Fat (Marbling)

- **Meat with higher marbling generally has a better eating quality, as fat adds moisture and flavor during cooking**

Cooking Method

- **Low and slow cooking methods (e.g., roasting, slow-cooking) can tenderize tougher cuts.**
- **High-heat methods (e.g., grilling, frying) may dry out lean cuts if not carefully managed.**
- **Overcooking can make meat tough and dry, while proper cooking enhances juiciness and tenderness**

Flavor

- **Meat flavor is influenced by fat content, diet, and the cooking method.**
- **Fat carries much of the flavor compounds, and the breakdown of proteins and fats during cooking creates the characteristic meat flavour.**

WHOLESOMENESS

- **Wholesomeness is one of the factors that affect meat quality, and it includes the microbiological, chemical, and nutritional quality of meat.**
- **Consumers value meat that is safe to eat, free of undesirable chemical residues, and provides sufficient nutrition.**
- **Appearance**
- **Animal welfare**
- **Tenderness**
- **Storage and preservation**
- **Microbial level**

- **Temperature Control**: Refrigeration helps slow down microbial growth. Freezing preserves meat for longer periods.
- **Moisture Content**: High moisture content provides a conducive environment for bacteria and mold.
- **Packaging**: Vacuum packaging or modified atmosphere packaging (MAP) reduces oxygen exposure, slowing microbial growth.
- **Enzymatic Activity**: Natural enzymes in meat can cause spoilage if not controlled by freezing or refrigeration.
- **Light Exposure:** UV light can accelerate oxidation and microbial growth.

PROCESSING AND PRESERVATION FISH AND IT'S PRODUCTS

maintaining their quality, extending shelf life, and ensuring food safety

PROCESSING OF FISH

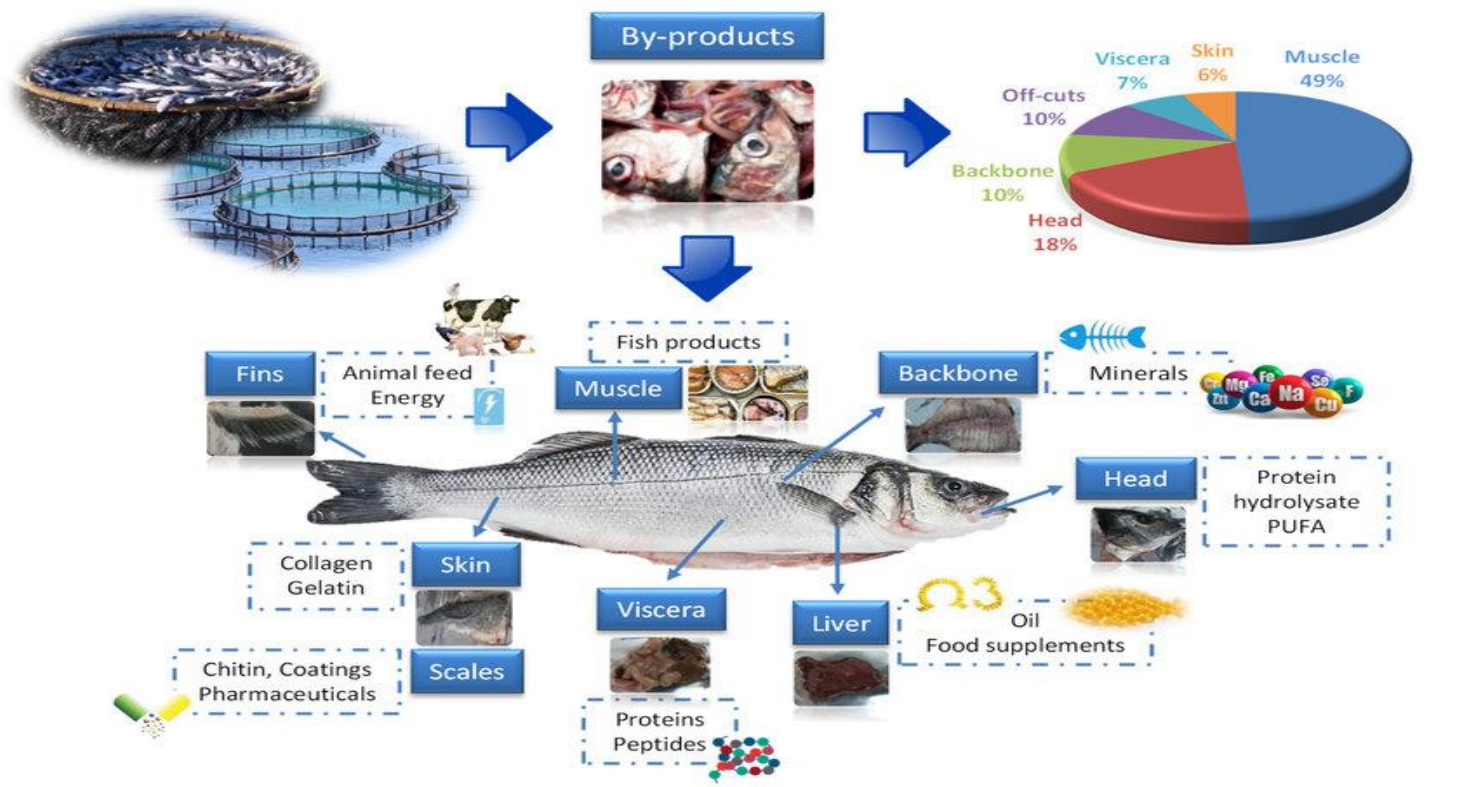
- **Cleaning: Removing scales, entrails, and gills. Filleting or cutting into steaks.**
- **Deboning: Removing bones, especially for certain products like fillets.**
- **Freezing: Quick freezing (IQF – Individually Quick Frozen) is common to preserve fish.**
- **Drying: Water removal by air or sun drying (e.g., dried fish), reducing microbial growth.**

- **Smoking: Exposing fish to smoke from burning wood to give flavor and preservative properties (smoked salmon, for example).**
- **Canning: Cooking and sealing fish in airtight containers, often in brine or oil (e.g., canned tuna, sardines).**
- **Fermentation: Process where microorganisms like bacteria break down the fish to develop distinct flavors (e.g.,fermented fish products).**

PRESERVATION METHODS

- **Refrigeration: Keeps fish cool, slowing bacterial growth. Short-term preservation.**
- **Freezing: Most common for long-term preservation, where fish is stored at sub-zero temperatures.**
- **Salting: Can be dry salting (direct application of salt) or wet salting (brining in saltwater solution).**
- **Smoking: Cold smoking (smoked but not cooked, needs further cooking) or hot smoking (cooked and ready to eat).**
- **Drying/Dehydration: Traditional method where fish is dried to remove moisture (can be air-dried or sun-dried).**

- **Vacuum Sealing: Air is removed to reduce oxidation and bacterial growth.**
- **Pickling: Preserving fish in acidic mediums (like vinegar) or with the addition of salt and spices.**



FACTORS AFFECTING FISH QUALITY

- **Handling: Improper handling during catching or transport can lead to spoilage.**
- **Temperature: Maintaining low temperatures is key to minimizing bacterial growth.**
- **Moisture Control: Water activity in fish should be controlled through drying, salting, or freezing.**
- **Oxidation: Fish are high in fats and can spoil via oxidation, making vacuum sealing and freezing important.**

Introduction to Fish Preservation

Importance of Fish Preservation:

•Fish is highly perishable due to its high moisture and protein content.

•Preservation slows down bacterial growth and enzymatic reactions, preventing spoilage.

•Extending shelf life ensures fish availability throughout the year, especially in non-coastal areas.

Objectives of Preservation Techniques:

•Maintain nutritional value (proteins, omega-3 fatty acids).

•Retain flavor and texture as much as possible.

•Meet consumer safety standards.

Overview of Fish Preservation Methods

Common Techniques: Canning, Smoking, Freezing, Salting, Drying

Traditional vs. Modern Techniques:

•Traditional methods: Salting, drying, and smoking were used before refrigeration.

•Modern methods: Canning and freezing use advanced technology for preservation.

Factors Influencing Technique Selection:

•Type of fish (fatty or lean).

•Desired storage duration (short-term vs. long-term).

•Market preferences for flavor and texture.

Canning of Fish

What is Canning?

• A thermal preservation technique where fish is processed at high temperatures, sealed in airtight containers to prevent contamination.

Canning Process:

1.Preparation: Cleaning, scaling, gutting, and sometimes pre-cooking.

2.Packing: Fish is packed in cans with or without added brine, oil, or sauces.

3.Sealing: Cans are sealed under vacuum to remove air.

4.Heat Processing: Cans are heated at high temperatures (121°C) to kill pathogens.

5.Cooling and Storage: Cans are cooled rapidly to prevent overcooking and stored at room temperature.

Types of Fish Suitable for Canning

- **Fish Types and Characteristics:**
- **Salmon:** Rich in omega-3 fats, holds texture well after canning.
- **Tuna:** High protein and popular for salads and sandwiches.
- **Sardines and Mackerel:** High-fat content enhances flavor, and they are small enough for canning whole.
- **Importance of Fat Content:** Fatty fish are preferred for canning as their oils help retain moisture and flavor during processing.

Advantages and Disadvantages

Advantages

- **Extended Shelf Life:** Can last 1-5 years if stored correctly.
- **Safe Storage:** Resistant to bacteria when processed properly.
- **Convenient for Transportation:** Cans are easy to stack and transport without refrigeration.

Disadvantages

- **Texture and Flavor Changes:** Some loss of fresh texture and flavor.
- **Nutrient Loss:** Heating can reduce levels of heat-sensitive nutrients like Vitamin C.
- **Potential Health Risks:** Improper canning may lead to botulism.

Smoking of Fish

What is Smoking?

- Fish is cured by exposing it to smoke, which has both drying and antimicrobial effects.

Types of Smoking:

- **Cold Smoking:** 20-30°C (68-86°F) for flavor, without cooking the fish.
- **Hot Smoking:** Above 65°C (150°F) for cooking and preservation.

Smoking Process:

- **Preparation:** Cleaning and salting to enhance flavor and act as an additional preservative.
- **Drying:** Allows fish surface to develop a tacky layer that helps smoke adhere.
- **Smoking:** Exposing fish to smoke from specific woods for hours to days.
- **Packaging and Storage:** Stored in cool, dry conditions to maintain quality.

Advantages and Disadvantages of Smoking

Advantages

•**Enhanced Flavor:** Smoky aroma and taste are highly desirable in culinary applications.

•**Partial Preservation:** Smoke's drying and antimicrobial effects prevent rapid spoilage.

Disadvantages

•**Limited Shelf Life:** Usually lasts a few weeks to months, especially if cold-smoked.

•**Requires Specialized Equipment:** Smokers or wood chips are needed for consistent results.

•**Storage Sensitivity:** Must be kept in cool, dry conditions for best quality.

Freezing of Fish

What is Freezing

•Fish is preserved by rapidly lowering its temperature, stopping microbial activity.

Freezing Process

1.Cleaning and Preparing: Gutting, scaling, and cutting.

2.Pre-Treatment: Dipping in salt solution or glazing with water to prevent freezer burn.

3.Freezing: Quick freezing at -30°C to -40°C to avoid large ice crystals.

4.Storage: Kept at -18°C or lower to ensure preservation.

Special Techniques: Flash-freezing or Individual Quick Freezing (IQF) to maintain texture

Types of Fish Suitable for Freezing

- **Best Fish for Freezing:**
  - **Cod, Salmon, Shrimp:** These retain texture and taste well after thawing.
  - **Lean vs. Fatty Fish:** Both types can be frozen; however, high-fat fish may experience slight texture changes.
- **Importance of Rapid Freezing:** Helps maintain cell structure, resulting in better texture and moisture retention upon thawing.

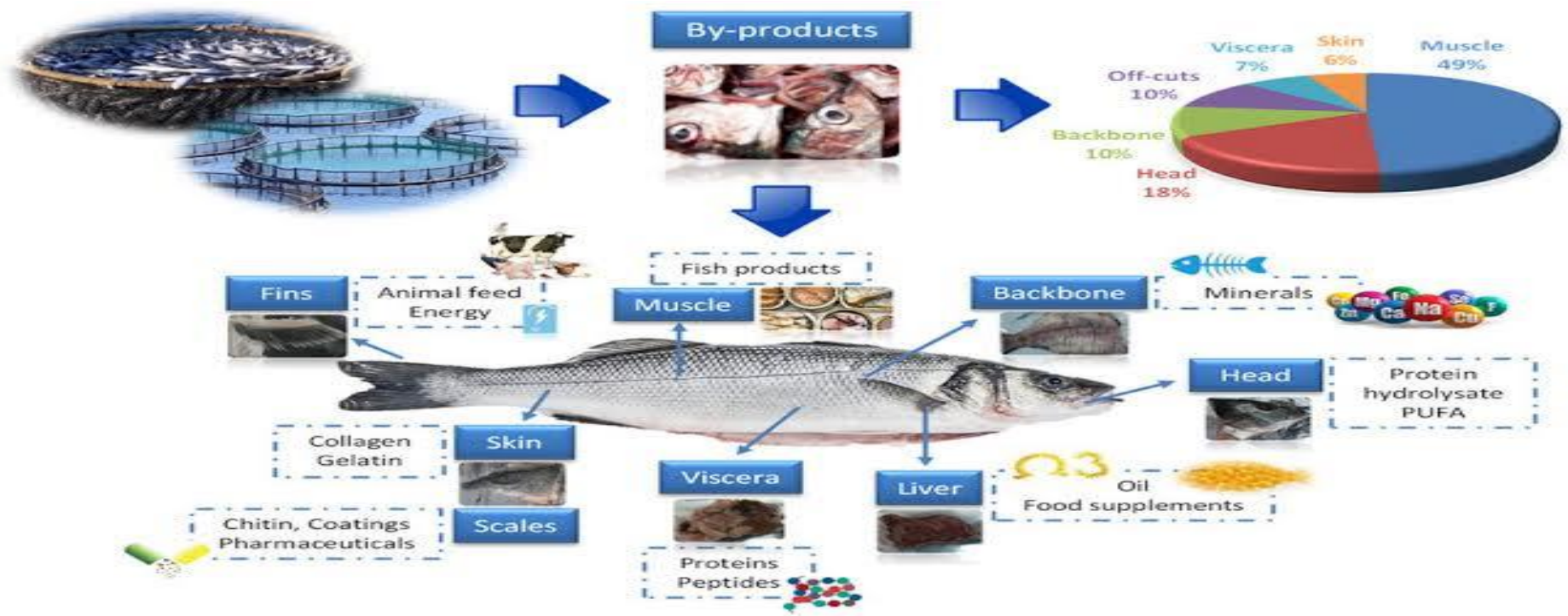
Comparison of Canning, Smoking, and Freezing

Method	Shelf Life	Flavor Impact	Nutritional Impact	Storage Needs
Canning	1-5 years	Moderate	Minor loss in some nutrients	Room temperature
Smoking	Weeks to months	High	Retains protein but loses moisture	Cool, dry place
Freezing	6-12 months	Minimal	High nutrient retention	Freezer at -18°C or lower

Utilization of by product from fish processing industries

By- products from fish processing

- By-products from fish processing industries hold significant potential for sustainable utilization. Instead of being treated as waste, these by-products can be used in various valuable ways, contributing to economic and environmental benefits



Fishmeal and Fish Oil Production

- **Fishmeal**: By-products like fish heads, bones, and viscera are processed into fishmeal, a protein-rich ingredient used in animal feeds, particularly for aquaculture, poultry, and livestock.
- **Fish Oil**: Fish oil, rich in omega-3 fatty acids, is extracted from fatty fish by-products and used in food supplements, nutraceuticals, and animal feed.

Bioactive Compounds for Pharmaceuticals and Nutraceuticals

- Collagen and Gelatin: Fish skins and scales are rich in collagen, used in cosmetics, pharmaceuticals, and food products to improve skin health, promote joint health, and create biodegradable films.
- Enzymes: By-products such as fish guts can be used to extract enzymes like trypsin and chymotrypsin, which are valuable in medicine and various industrial processes.

Chitosan Production

Shells of Crustaceans: Crustacean shells (e.g., shrimp and crab) are used to produce chitosan, a biopolymer with applications in water treatment, food preservation, pharmaceuticals, and biodegradable packaging.

Pet Food and Treats

Low-value fish parts, such as frames and skins, can be processed into pet food or chews, providing a nutritious source of protein for pets.

Fertilizers and Soil Conditioners

Fish waste is processed into organic fertilizers, rich in nitrogen, phosphorus, and potassium, making it an excellent natural soil conditioner for agriculture

Fish Protein Hydrolysates

Enzymatic hydrolysis of fish by-products produces fish protein hydrolysates, which have uses in functional foods, dietary supplements, and sports nutrition due to their bioavailability and bioactive properties.

Biogas Production

Anaerobic digestion of fish processing waste can produce biogas, a renewable energy source that can power processing facilities or be used for heating and electricity.

Cosmetic and Skincare Products

Fish-derived collagen and oils are incorporated into skincare and cosmetic products due to their anti-aging and moisturizing properties.

Additional Uses of Fish Processing By-Products

- **Food Products and Ingredients**
- **Fish Protein Powder:** Fish proteins can be extracted and dried into powders that are used as supplements to increase the nutritional profile of processed foods, dietary products, and baked goods.
- **Flavor Enhancers and Seasonings :** Hydrolyzed fish proteins are used in sauces, soups, and savory products to enhance flavor, often marketed in bouillon cubes or seasonings.
- **Pharmaceutical and Medical Applications**
- **Omega-3 Fatty Acids:** Fish oil, derived from fatty fish tissues, is a primary source of omega-3 fatty acids (EPA and DHA), essential for heart health. These are used in dietary supplements and pharmaceuticals.
- **Antioxidant Peptides:** Extracted peptides from fish processing by-products are known for their antioxidant properties, which make them valuable for functional foods and nutraceuticals.

Cosmetic and Skincare Industry

Collagen for Skin Care: Collagen derived from fish skins and scales is used in skincare products to promote anti-aging and enhance skin elasticity. It is highly valued in anti-wrinkle creams, serums, and beauty drinks.

Marine-Based Active Ingredients: Fish extracts, such as oils and peptides, are incorporated into creams and moisturizers to provide hydration and improve skin texture.

Agricultural Applications

Organic Fertilizers: Fish waste can be composted into organic fertilizers that enrich soil with essential nutrients, improving crop yields and promoting sustainable farming practices.

Fish Emulsion: A liquid fertilizer made from fish waste is widely used in horticulture and gardening to provide nutrients to plants.

Economic and Environmental Benefits

Utilizing fish processing by-products contributes significantly to:

Reducing Waste: By transforming potential waste into valuable products, fish processing industries reduce the environmental impact of their operations.

Creating Jobs and Economic Value: Processing and repurposing by-products create employment opportunities and additional revenue streams for communities involved in fisheries and aquaculture.

EGG PRODUCTS…….

INTRODUCTION

EGGS

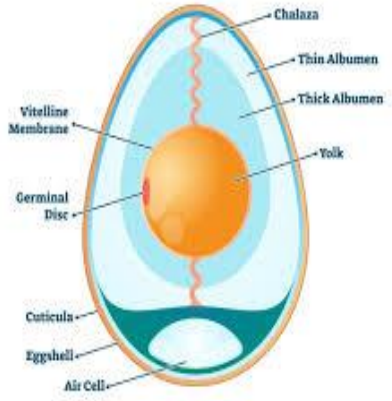
1. Nutrient-Rich: Eggs are packed with protein, amino acids, vitamins, and minerals.

2. High Biological Value : Both the yolk and white are easily digested and provide quality protein.

3. Culinary Versatility: Eggs are used in many dishes due to their versatility.

4. Functional Properties: They can emulsify, thicken, foam, and moisturize, enhancing food texture and function.

5. Industrial Use: Eggs are important in food production for various products.



EGG POWDER:

- An egg consists of 3 main parts: the shell (10%), the albumen or egg white (60%) and the yolk (30%).
- An average egg weighs about 55-60 gram. Egg, in full or parts, is used to prepare powder used in different industries:
- Whole egg powder (WEP) is used in classical food applications where rising qualities are not essential, such as crackers, cookies and pasta.
- Egg yolk powder (EYP) is used as a substitute for fresh egg yolk to obtain colour, texture, and emulsion capacity.
- Egg yolk powder is most frequently used in mayonnaise, dressings, sauces and croissants.
- Egg albumen powders (EAP) is used in a range of items from fish, meat, and potato preparations to bakery and pastry products

DRYING METHODS OF EGG POWDER

- Pan drying
- Foam-drying
- Freeze-drying
- Oven drying
- Spray-drying* *frequently used

pan drying and drum drying are not used because of their inherent disadvantages.

Also freeze drying is not used because of its higher cost.

PREPARING EGG

Eggs are prepared for drying by transferring them from cold storage to a holding room, where they are examined for quality attributes using a Flash handler.

Spoiled eggs are removed and sold to hatcheries. After washing, eggs are dried using hot air. After decontamination, the eggs are broken by the egg breaker, break 30,000 eggs per hour and separated into yolk and white.

The egg liquid is desugarized to prevent maillard reactions. Activated dry yeast is added to the mixture, and fermentation is carried out at 36°C for 90 minutes.

After desugaring, pasteurization is done by heating at a minimum temperature of 64.4°C for at least 2.5 minutes.

This time/ temperature relationship effectively destroys all pathogens and reduces total bacterial counts to a low level. After pasteurization, the egg is cooled to below 4°C to spray drying

SPRAY DRYING

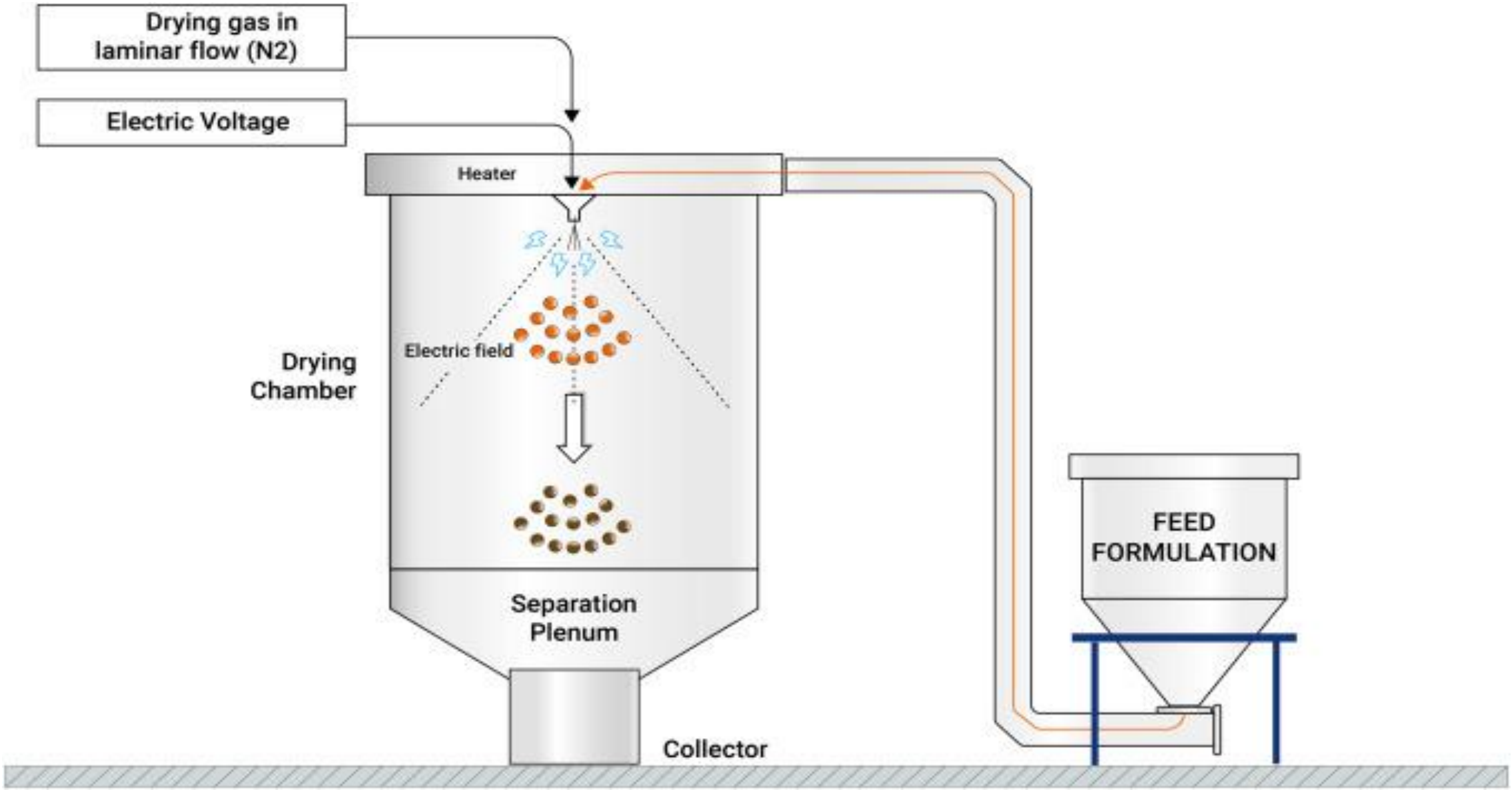
The spray drying method usually involves initially preparing a solution of raw materials,

Spray drying technology involves several steps, including feed concentration, feed atomization, chamber air-droplet contact, and moisture evaporation.

The first stage involves a constant rate of evaporation, with sufficient moisture in the drop to replace evaporated liquid.

The second stage begins when there is no more moisture, forming a dried shell at the surface. The rate of evaporation depends on moisture diffusion through the shell, which increases in thickness as evaporation progresses.

The final step is the separation stage, using cyclones, bag filters, and electrostatic precipitators.


Drying gas in laminar flow (N2)
Electric Voltage
Heater
Electric field
Drying Chamber
Separation Plenum
Collector
FEED FORMULATION

PAN DRYING METHOD

Pan drying can be done in two ways: cook dry and wet dry.

Cook dry methods : involves whipping up eggs, cooking them in a non-stick frying pan, and drying them in a dehydrator at 145 degrees Fahrenheit for 4 hours.

The eggs are then chopped into dried chunks and mashed into a powdery consistency.

This method is quick but may not be suitable for baked goods that require a "leavening" property.

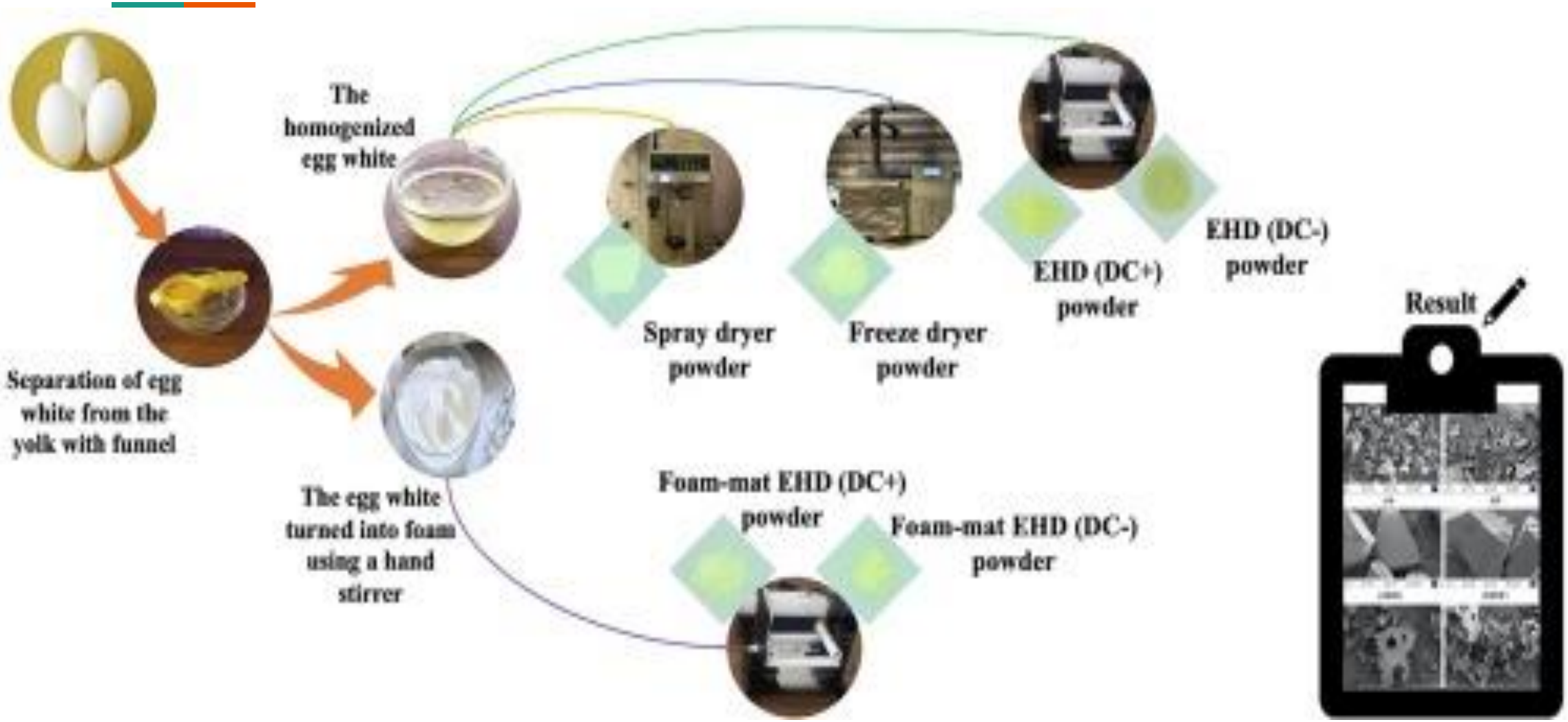
wet dry method: eggs are whipped up, poured onto a fruit roll sheet, and dried for 16 hours.

The powder turns orange when reconstituted and cooked like scrambled eggs, but maintains the "leavening" property and fluffs up, making it suitable for baking.

Leavening is the process of adding air or carbon dioxide bubbles to doughs and batters to make them lighter and softer

. **Oven drying • The** product of egg white, egg yolk and whole egg should keep inside the cross-grilled trays of vacuum oven, the temperature and pressure of the vacuum system should be controlled and set optimum (temperature: 50ºC, pressure pump should be adjusted to a limit of 700 atm (bar)). As soon as the pressure is attained, the obtain product dry for another 4-5 hours of complete vacuum drying with temperature of around 50ºC. The dehydrated product achieve and send for blending into powder.

Freeze drying is a new method of drying egg products by which water is removed from a product while it is in the frozen state. The product is frozen and then subjected to a high vacuum. Heat is supplied to the product while it is drying.


The homogenized egg white
Separation of egg white from the yolk with funnel
The egg white turned into foam using a hand stirrer
Spray dryer powder
Freeze dryer powder
EHD (DC+) powder
EHD (DC-) powder
Foam-mat EHD (DC+) powder
Foam-mat EHD (DC-) powder
Result

TECHNOLOGY OF EGG ALBUMEN PRODUCTS

Albumen, or egg white, is the clear liquid part of an egg, primarily composed of water and proteins.

Processing

1. Separation: Albumen is separated from the yolk using mechanical or manual methods.

2. Pasteurization: It is often pasteurized to eliminate pathogens, enhancing safety for raw or lightly cooked applications.

3. Concentration: The liquid albumen can be concentrated by removing some water, increasing its protein content.

4. Drying: Albumen can be dried through spray or freeze-drying to create powdered egg white, which has a long shelf life and is easy to transport.

Applications: Used in meringues, mousses, and baked goods for their foaming and binding properties.

- Nutritional Products: Incorporated into protein supplements and health foods.

- Industrial Uses: Used in food processing, cosmetics, and pharmaceuticals due to its emulsifying and stabilizing abilities.

Benefits: Nutrient-Rich: High in protein and low in fat, making it a popular choice for health-conscious consumers.

FLAKES

Egg flakes are dehydrated eggs that have been processed into thin, flat pieces or flakes. They are designed for easy storage, long shelf life, and convenience in cooking.

Processing Steps:

1. Separation: Whole eggs or just egg whites/yolks are separated as needed.

2. Whipping:The eggs are whipped to incorporate air, creating a uniform texture that helps in drying.

3. Cooking: The whipped egg mixture is cooked gently, typically in a steam or dry heat process, to set the proteins and create a stable structure.

4. Dehydration:

- The cooked eggs are spread out in thin layers on trays or sheets and dried using methods like:

  - Hot Air Drying: Heated air removes moisture.

  - Freeze Drying: Eggs are frozen and then dehydrated under a vacuum, preserving flavor and nutrients.

5. Flaking:Once fully dried, the egg product is broken down into flakes or smaller pieces, facilitating easier rehydration and use.

6. Packaging:The flakes are packaged in moisture-proof containers to ensure freshness and extend shelf life.

Uses: Egg flakes can be rehydrated and used in various dishes like omelets, soups, casseroles, and baked goods.

- Emergency Food Supply: Due to their long shelf life, they are popular in camping and emergency food kits.

- Convenience Foods: Used in ready-to-eat meals, snack bars, and other processed foods for added protein.

Benefits:

- Nutritional Value: Egg flakes retain much of the nutritional content of fresh eggs, including high protein levels.

- Storage and Shelf Life: They can be stored for months or even years without refrigeration, making them a practical choice for long-term storage.

- Ease of Use: Quick to prepare—just rehydrate and cook, saving time in meal preparation.

- Versatility: Can be used in both savory and sweet recipes, offering flexibility in cooking.