UNIT 3

Food safety standards: Food Hygiene

Food safety is a scientific discipline describing handling, preparation, and storage of food in ways that prevent food borne.

Importances of food safety and hygiene

- Prevent food spoilage, i.e. changes that make food unfit for consumption due to microbial or chemical contamination.
- Inform and educate people about simple and practical methods of keeping food safe to protect themselves against foodborne diseases.
- Protect food from adulteration (intentional contamination).
- Ensure proper practice in the food trade to prevent the sale of food that is offensive or defective in value and quality

Food hazards

Food hazards refer to any biological, chemical, or physical agent in food that may cause harm to the consumer. It's crucial to identify and manage these hazards to ensure the safety and quality of the food supply. Here are the main types of food hazards:

Biological Hazards:

Bacteria: Pathogenic bacteria such as Salmonella, Escherichia coli (E. coli), Listeria, and Campylobacter can cause foodborne illnesses.

Viruses: Norovirus, Hepatitis A, and other viruses can contaminate food, especially through contact with infected food handlers.

Parasites: Protozoa, roundworms, and flatworms are examples of parasites that can be transmitted through contaminated food or water.

Chemical Hazards:

Chemical contaminants: Pesticides, herbicides, and other agricultural chemicals can be present in or on food if not properly monitored.

Food additives: While many food additives are safe, improper use or contamination can pose risks. Examples include artificial colors, preservatives, and flavor enhancers.

Toxins: Some naturally occurring substances, such as mycotoxins (produced by fungi), marine toxins, and plant toxins, can contaminate food.

The examples of the chemicals hazards are indicated.

Table 2.3: Types of chemical hazards

Food Borne Toxicants		
Naturally Occurring Chemicals	**Unintentional Chemicals**	**Intentional Chemicals**
Found in plants, microorganisms and animals e.g. mycotoxins, histamine, mushroom toxins, shellfish toxins etc.	Lead, Polychlorinated biphenyls (PCBs) and paralysis products etc.	Food additives, pesticides, drugs

Physical Hazards:

Physical hazards include a variety of materials often referred to as extraneous materials. It may be defined as any foreign material not normally found in a food, which may cause illness or injury to the individuals consuming/using the product. They may cause injury, illness and others may never be noticed.

Foreign objects: Physical contaminants like glass, metal, plastic, or wood can accidentally get into food during processing, handling, or packaging.

Allergens: Ingredients that can cause allergic reactions in some individuals (e.g., nuts, shellfish, gluten) need to be clearly labeled to prevent unintentional exposure.

Few of visible physical hazards are highlighted in Table 2.1

Table 2.1: Hazards associated with food

Physical	Biological	Chemical		Allergens
		Natural occurring poisons of biological origin	Chemicals or deleterious substances	
Glass Hair Metal Stones Plastic Parts of pests Insulation material Bone Fruit pits	Microbiological Pathogenic Bacteria • Spore-forming • Non spore-forming Parasites and protozoa Viruses	Mycotoxins, Algal toxins	Veterinary residues, Antibiotics Growth stimulants Plasticisers and packaging material Chemical Residues Pesticides Cleaning fluids, Allergens Toxic metals, Lead and cadmium, Food chemicals preservatives, processing aids, polychlorinated biphenyls (PCBs), printing inks, prohibited	Cereals containing gluten; i.e wheat, barely, oats etc. Crustaceans and product of these Eggs and egg products fish and fish products Peanuts,soyabean and products of these; Milk and milk products.

Allergenic Hazards:

Certain foods and food ingredients can cause allergic reactions in susceptible individuals. Cross-contamination and mislabeling are common causes of allergen-related incidents. Food allergy symptoms include: wheezing or breathing problems, stomach cramps, vomiting, diarrhea, hives, rashes or eczema, whereas, severe allergic reactions can cause death.

A food allergy occurs when the immune system:

- Identifies a particular food protein as danegerous and create antibodies against it.
- The next time the individual eats that food, immune system tries to protect the body against the danger by releasing massive amount of chemicals including Histamine.
- Histamine is a powerful chemical that can cause a reaction in the respiratory system, gasterointestinal tract, skin or cardiovascular system.
- In the most extreme cases, food allergy can be fatal. Although any food can provoke an immune response in allergic individuals, a few foods are responsible for the majority of food allergies.

Radiological Hazards:

Contamination with radioactive substances can occur, especially in certain types of fish or in areas with nuclear incidents.

Preventing and managing food hazards involve implementing good manufacturing practices (GMP), Hazard Analysis and Critical Control Points (HACCP), and other food safety management systems. Regular inspections, testing, and proper labeling are also essential components of ensuring food safety. Consumers can contribute to their safety by practicing proper food handling, cooking, and storage at home. Public health agencies and regulatory bodies play a crucial role in monitoring and enforcing food safety standards to protect the public.

Food Safety Regulations –

An Approach to Food Safety

A basic food safety plan uses the HACCP method. HACCP stands for **hazard analysis critical control points.** HACCP was originally developed by NASA to make sure the food on their space flights was safe to eat. HACCP is not a complicated process; it just means that you have to first identify the various steps you must take when you prepare your menu items, then look for possible sources of contamination, and then find ways to control these sources. The HACCP approach HACCP is an approach to food safety that is systematic and preventive. It is recommended by the Codex Alimentarius Commission, the United Nations international standards organization for food safety. HACCP is used by most countries around the world and has been in use since the 1960s. HACCP goes beyond inspecting finished food products. It helps to find, correct, and prevent hazards throughout the production process. These include physical, chemical, and biological hazards.

HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product

HACCP and the Seven Principles

HACCP (Hazard Analysis Critical Control Point) is defined as a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product. The goal of HACCP is to prevent and reduce the occurrence of food safety hazards.

It is based on the application of scientific principles to food processing and production. The University of Nebraska has been providing educational programs and assistance to food processing and food production professionals since 1993.

HACCP training is for meat and poultry processors, food processors, and food service operators.

There are seven universally accepted HACCP principles. Every country that uses HACCP follows these principles.

Principle 1: Conduct a Hazard analysis

The application of this principle involves listing the steps in the process and identifying where significant hazards are likely to occur. The HACCP team will focus on hazards that can be prevented, eliminated or controlled by the HACCP plan. A justification for including or excluding the hazard is reported and possible control measures are identified

Principle 2: Identifying critical control points

A critical control point (CCP) is a point, step or procedure at which control can be applied and a food safety hazard can be prevented, eliminated or reduced to acceptable levels. The HACCP team will use a CCP decision tree to help identify the critical control points in the process. A critical control point may control more than one food safety hazard or in some cases more than one CCP is needed to control a single hazard. The number of CCP's needed depends on the processing steps and the control needed to assure food safety.

For example, the cooking step is considered a critical control point because control measures are necessary to deal with the hazard of pathogens surviving the cooking process.

Principle 3: Establishing critical limits for each critical control point

A critical limit (CL) is the maximum and/or minimum value to which a biological, chemical, or physical parameter must be controlled at a CCP to prevent, eliminate, or reduce to an acceptable level the occurrence of a food safety hazard. The critical limit is usually a measure such as time, temperature, water activity (aw), pH, weight, or some other measure that is based on scientific literature and/or regulatory standards.

A critical limit is the limit at which a hazard is acceptable without compromising food safety. For example, critical limits at the cooking stage include specific time and temperature for cooking the product.

Principle 4: Establishing monitoring procedures for critical control points

The HACCP team will describe monitoring procedures for the measurement of the critical limit at each critical control point. Monitoring procedures should describe how the measurement will be taken, when the measurement is taken, who is responsible for the measurement and how frequently the measurement is taken during production.

Highly detailed monitoring activities are essential to make sure the process continues to operate safely and within the critical limits at each critical control point. For example, monitoring procedures at a cooking critical control point could include taking the internal temperature of the product with a specialized thermometer.

Principle 5: Establishing corrective actions

Corrective actions are the procedures that are followed when a deviation in a critical limit occurs. The HACCP team will identify the steps that will be taken to prevent potentially hazardous food from entering the food chain and the steps that are needed to correct the process. This usually includes identification of the problems and the steps taken to assure that the problem will not occur again.

Principle 6: Establishing verification procedure

Verification means applying methods, procedures, tests, sampling and other evaluations (in addition to monitoring) to determine whether a control measure at a critical control point is or has been operating as intended. Verification activities also ensure that the monitoring and the corrective actions are done according to a company's written HACCP program. For example, testing and calibrating thermometers is a verification procedure that is important to ensure accurate readings. The easiest way to test a thermometer's accuracy is by submerging the probe into a pot of boiling water. If it does not read 100˚C (212˚F) then the thermometer must be adjusted to read the correct temperature. The HACCP team may identify activities such as auditing of CCP's, record review, prior shipment review, instrument calibration and product testing as part of the verification activities.

Principle 7: Establish Record-keeping and Documentation Procedures.

A key component of the HACCP plan is recording information that can be used to prove that the food was produced safely. The records also need to include information about the HACCP plan. Record should include information on the HACCP Team, product description, flow diagrams, the hazard analysis, the CCP's identified, Critical Limits, Monitoring System, Corrective Actions, Recordkeeping Procedures, and Verification Procedures

The company must keep records to demonstrate the effective application of the critical control points and assist with official verification. Records must be established to document the monitoring and verification results as well as all information and actions taken in response to any deviations found through monitoring and verification.

For example, the employee responsible for monitoring a cooking critical control point completes a cooking log sheet. This sheet includes the date, the start and finish time, the temperature, and the employee's signature. If a deviation has occurred in the production process, the responsible employee records the details in a deviation log book.

Factors that contribute to foodborne illness

Foodborne illnesses, also known as food poisoning, can be caused by various factors. These illnesses result from the consumption of contaminated food or beverages. Several factors contribute to the occurrence and spread of foodborne illnesses:

Microbial Contamination:

Bacteria: Pathogenic bacteria like Salmonella, Escherichia coli (E. coli), Listeria, and Campylobacter are common culprits. These bacteria can multiply rapidly in certain conditions and produce toxins that cause illness.

Viruses: Norovirus, Hepatitis A, and rotavirus are examples of viruses that can contaminate food and cause illness.

Parasites: Protozoa, roundworms, and flatworms can contaminate food, especially undercooked meat and seafood.

Cross-Contamination:

Cross-contamination occurs when pathogens are transferred from one surface to another, such as from raw meat to vegetables or from hands to food. This can happen through shared cutting boards, utensils, or hands that have not been properly washed.

Improper Food Handling and Storage:

Poor hygiene practices during food preparation, inadequate cooking temperatures, and improper storage conditions can lead to the growth of harmful microorganisms. Perishable foods should be stored at appropriate temperatures to prevent bacterial growth.

Contaminated Water and Ice:

Water and ice can carry harmful pathogens if contaminated. Consuming food or drinks made with contaminated water or ice can lead to foodborne illnesses.

Inadequate Cooking or Heat Treatment:

Insufficient cooking temperatures may not kill pathogens present in food. It is crucial to cook food thoroughly, especially meat, poultry, and seafood, to eliminate harmful microorganisms.

Unsafe Sources:

Consuming raw or undercooked seafood, eggs, and meat poses a higher risk of foodborne illness. Unpasteurized milk and dairy products can also carry pathogens.

Inadequate Personal Hygiene:

Poor personal hygiene of food handlers, such as not washing hands properly, can introduce harmful bacteria and viruses into the food they handle.

Contaminated Equipment and Utensils:

Kitchen equipment and utensils, if not cleaned and sanitized properly, can be a source of contamination. Cutting boards, knives, and other utensils should be washed thoroughly to prevent cross-contamination.

Food from Unsafe Sources:

Food obtained from contaminated or unsanitary sources, such as street vendors with poor hygiene practices or unregulated food suppliers, can pose a risk of foodborne illness.

Inadequate Food Safety Practices:

Lack of awareness or adherence to proper food safety practices, both in households and food establishments, contributes to the occurrence of foodborne illnesses.

To prevent foodborne illnesses, it is essential to practice good hygiene, follow proper food handling and cooking procedures, and be vigilant about the sources and quality of the food consumed. Public health measures and regulations also play a crucial role in ensuring food safety.

Preventing Foodborne Illness

Food-handling and Storage Procedures

Proper food handling and storage can prevent most foodborne illnesses. In order for pathogens to grow in food, certain conditions must be present. By controlling the environment and conditions, even if potentially harmful bacteria are present in the unprepared or raw food, they will not be able to survive, grow, and multiply, causing illness.

There are six factors that affect bacterial growth, which can be referred to by the mnemonic FATTOM:

1. Food

2. Acid

3. Temperature

4. Time

5. Oxygen

6. Moisture

Each of these factors contributes to bacterial growth in the following ways:

• **Food:** Bacteria require food to survive. For this reason, moist, protein-rich foods are good potential sources of bacterial growth.

• **Acid:** Bacteria do not grow in acidic environments. This is why acidic foods like lemon juice and vinegar do not support the growth of bacteria and can be used as preservatives

• **Temperature**: Most bacteria will grow rapidly between 4°C and 60°C (40°F and 140°F). This is referred to as the **danger zone**

• **Time:** Bacteria require time to multiply. When small numbers of bacteria are present, the risk is usually low, but extended time with the right conditions will allow the bacteria to multiply and increase the risk of contamination

• **Oxygen:** There are two types of bacteria. **Aerobic bacteria** require oxygen to grow, so will not multiply in an oxygen-free environment such as a vacuum-packaged container. **Anaerobic bacteria** will only grow in oxygen-free environments. Food that has been improperly processed

and then stored at room temperature can be at risk from anaerobic bacteria. A common example is a product containing harmful Clostridium botulinum (botulism-causing) bacteria that has been improperly processed during canning, and then is consumed without any further cooking or reheating.

• **Moisture:** Bacteria need moisture to survive and will grow rapidly in moist foods. This is why dry and salted foods are at lower risk of being hazardous.

Identifying Potentially Hazardous Foods (PHFs)

Foods that have the FATTOM conditions are considered **potentially hazardous foods (PHFs).** PHFs are those foods that are considered perishable. That is, they will spoil or "go bad" if left at room temperature. PHFs are foods that support the growth or survival of disease-causing bacteria (pathogens) or foods that may be contaminated by pathogens.

The Danger Zone

One of the most important factors to consider when handling food properly is temperature. Table 3 lists the most temperatures to be aware of when handling food.

Table 3. Important temperatures to remember

Celsius	Fahrenheit	What happens?
100°	212°	Water boils
60°	140°	Most pathogenic bacteria are destroyed. Keep hot foods above this temperature.
20°	68°	Food must be cooled from 60°C to 20°C (140°F to 68°F) within two hours or less
4°	40°	Food must be cooled from 20°C to 4°C (68°F to 40°F) within four hours or less
0°	32°	Water freezes
–18°	0°	Frozen food must be stored at −18°C (0°F) or below

The range of temperature from 4°C and 60°C (40°F and 140°F) is known as the danger zone, or the range at which most pathogenic bacteria will grow and multiply

Time-temperature Control of PHFs

Pathogen growth is controlled by a time-temperature relationship. To kill micro-organisms, food must be held at a sufficient temperature for a sufficient time. Cooking is a scheduled process in which each of a series of continuous temperature combinations can be equally effective. For example, when cooking a beef roast, the microbial lethality achieved at 121 minutes after it has reached an internal temperature of 54°C (130°F) is the same as if it were cooked for 3 minutes after it had reached 63°C (145°F).

History of food safety Act

The **Food Safety and Standards Authority of India** (**FSSAI**) is a statutory body under the administration of the Ministry of Health and Family Welfare, Government of India. It regulates the manufacture, storage, distribution, sale, and import of food articles, while also establishing standards to ensure food safety. The FSSAI was established by the Food Safety

and Standards Act, 2006, which consolidated all former acts and orders related to food safety that were previously handled by various ministries and departments.

The FSSAI has its headquarters at New Delhi. There are 22 referral laboratories notified by FSSAI, 72 State laboratories located throughout India and 112 laboratories are NABL accredited private laboratories notified by FSSAI.

The FSSAI is headed by a non-executive chairperson, appointed by the central government, either holding or has held the position of not below the rank of Secretary to the Government of India. The FSSAI provisions are enforced by Food Safety Officers. Food Safety Officers are responsible for enforcing and executing the provisions of the Food Safety and Standards Act, 2006 within their designated areas. The Commissioner of Food Safety and Designated Officer have the authority to exercise the same powers as Food Safety Officers.

Food Safety Officers possess the right to enter and inspect any place where food articles are manufactured, stored, or exhibited for commercial purposes. They are authorized to collect samples for analysis by a Food Analyst. The authority of a Food Safety Officer to enter and inspect premises is equal to that of a police officer equipped with a search warrant under the Code of Criminal Procedure (CrPC). They can issue registrations to food business operators

Functions of FSSAI

- Creating Guidelines and Standards – FSSAI establishes rules and norms that must be followed by all food production enterprises, taking hygiene and food safety into account.
- Awarding License — The proprietor must obtain a certificate and license from the FSSAI before starting any food-related business.
- The organization tests the standard and quality of food manufactured by all enterprises registered under the FSSAI.
- Conducting Audits — Food-producing and manufacturing enterprises are inspected to ensure that their standards meet the norms.
- Literacy about food safety – The FSSAI is r
- Literacy about food safety – The FSSAI is responsible for raising public awareness and informing citizens about the necessity of eating safe and hygienic food.
- Retain Records and Information – The FSSAI also keeps correct records and data for all registered organizations. Any breach of the FSSAI's rules might result in the license being revoked.
- Keeping the Government Informed — Any threat to food safety must be reported to the appropriate government authorities for further action. Assist them in developing food safety policies.

initiatives by FSSAI to ensure Food safety

FSSAI has also taken a number of critical initiatives to ensure food safety and standards. A couple of these significant undertakings are listed below:

- Eat Right India – The goal is to give quality meals to everyone, not only to supply food to everyone. FSSAI hopes to make good quality food available to all citizens of the country through this effort.

- Clean Street Food entails educating and training street food vendors by the FSSAI Act 2006. This will also assist street food vendors in their economic development.
- Diet4Life is another FSSAI project aimed at raising awareness about metabolic illnesses.
- Save Food, Share Food, Share Joy – encouraging people to donate food rather than waste it. FSSAI hopes to connect food-collecting agencies with food-producing corporations and then distribute the food to needy people.
- World Food Safety Day– FSSAI commemorated the first-ever World Food Safety Day on June 7, 2019, by recognizing the contributions of states, food industries, and citizens to food safety.
- Heart Attack Rewind– On November 30, 2018, the Food Safety and Standards Authority of India (FSSAI) launched the "Heart Attack Rewind" national media campaign to eliminate industrially manufactured trans-fat from the food supply. It will contribute to the FSSAI's global goal of eliminating trans-fat in India by 2022.

    - FSSAI-CHIFSS is a project between the FSSAI and the CII-HUL Initiative on Food Safety Sciences to foster food safety partnerships between industry, science, and academics.

FSSAI guidelines to limit trans-fat in food items

- India joins a group of roughly 40 countries around the world that have already implemented best-practice policies to remove trans fats and would be one of the first Asian countries to do so after Thailand.
- Industrial trans fatty acids are defined as: "All geometrical isomers of mono-unsaturated and polyunsaturated fatty acids with non-conjugated carbon-carbon double bonds in the trans configuration, interrupted by at least one methylene group.
- By January 2021, industrial TFA (trans fatty acids) in all fats and oils must be no more than 3%, and no more than 2% by January 2022.
- According to the Food Safety and Standards (Prohibition and Restrictions on Sales) Second Amendment Regulations, 2021. On and after January 1, 2022, all food products that contain edible oils and fats as an ingredient must not contain industrial trans fatty acids in excess of 2% by mass of the total oils/fats present in the product
- Trans-fatty acids are prohibited in dairy, meat, fish, and their products.

FOOD ANAYSIS AND TESTING

Food product testing is considered as the most important step despite being the last process of the food manufacturing chain. Food product testing is vitally necessary, to assure that the food is free of physical, chemical, and biological hazards and also determines the safety of the food for use. Examples of potentially hazardous food contaminants include metals, pathogens, cleaning agents, additives, preservatives, pesticides, adulterants, and more. Food product testing also refers to the scientific analysis of food and its contents to provide information about characteristics of food like its structure, composition, and Physico chemical properties.

In India, regulations set up by FSSAI are most vital and should be followed and monitored regularly.

Food testing is crucial for food industries for many reasons as it covers wide range of requirements like

- Testing the quality of a product
- Quality control
- Food inspection and grading
- Food authenticity check
- Testing for adulterants
- Nutritional labelling
- Food nutrient content analysis
- Shelf-life analysis
- Sensory evaluation

Food Testing can benefit food production business

1. **Customers**: Protects and guaranteed prevention to customers from food-borne diseases.

2. **Manufacturers**: Assures product safety, approval to enter the market, and aids in brand reputation which in turn, leads to an increase in business ventures.

Techniques that take place in a food testing laboratory:

3. Analytical chemistry testing: This helps to identify, separate and even find the quantity of the chemical components of natural and artificial materials in the food product such as pH, additives, nutrients, preservatives, contaminants, minerals and much more.

4. Microbiology testing: This food testing helps food manufacturers identify the microorganisms that inhabit the food and understand the safety of the raw materials used in food production, ingredients as well as the final product. This is also used to test and examine spoiled pathogens to prevent food poisoning outbreaks that are generally caused by the products and the ingredients used in the products. This is also a necessity otherwise the whole supply chain can be contaminated and disrupted in the process of food production, leading to not only a danger to the general public but also a hefty loss of money.

5. Food allergen test: Food allergens are proteins that appear in huge quantities. It helps to find the main target allergen in the ingredients and finished food product. Normally allergens are tested in food products such as peanuts, gluten in grains, eggs, nuts and milk, etc.

6. Nutritional analysis: This area in food testing provides accurate information on the nutritional content of food products. This gives manufacturers the required details to include it on food packaging and ensure that they are following all compliances and labelling regulations.

Eurofins -Analytical Food Testing Laboratory

Eurofins is the world leading Food Testing laboratory group, deploying a comprehensive range of state-of-the-art analytical techniques in order to support its clients' increasingly stringent quality and safety standards.In India as Eurofins Analytical Services India Pvt Ltd and provide a comprehensive and one-stop testing service to businesses and organizations involved in food and feed processing, Agro products, Export, Hospitality and Retail chains.

The Eurofins Advantage

- Competence Centers with state-of-the-art equipment such as high-resolution GC, HPLCs, GCMSMS, FTIR, ELISA, HR-MS, GC-MS, HPLC, LC-MS/MS, ICP-MS, Real-time PCR and NMR systems
- Fast turn-around time (TAT)
- Local contact with a Global Network
- Participation in industry associations and regulatory bodies allowing early advice on potential food scares and legal obligations
- Expert advice - testing schemes, on-site-check for hygiene and allergens, labelling advice and traceability
- Results you can rely on
- International presence

Refer some applications of food testing

https://www.eurofins.in/food-testing/blog/importance-of-food-testing/

FSSAI Food Testing Procedure

To ensure the quality and safety of any food products, food sampling or food analysis can be ordered and carried out by an FSSAI Office. As per the Food and Safety Standards Act, testing of food articles is to be conducted once in six months through NABL accredited or FSSAI-notified lab. For a food analysis, a sample food product would be drawn, packed, sealed, and sent to an authorized lab to analyze the quality and safety of the food product. This article looks at the procedures followed during an FSSAI food testing procedure.

Importance of Laboratory testing Under FSSAI

Food testing and analysis are essential for the safekeeping of the food ecosystem. Food laboratory tests ensure that the food is safe for consumption.

- Food testing ensures that the products comply with the Food and Safety Standards Act:
- Lab testing Protect the brand equity and loyalty of consumers by delivering healthy food;
- Protects consumers from contaminated, modified, and healthy food;
- Ensures proper storage, packing, and distribution of food commodities; and
- Laboratory testing under FSSAI provides services in all areas of food testing, including-
  - Food adulterant testing
  - Chemical Contaminant testing
  - Microbial Testing
  - Drug Residue Testing

Procedure Involved in FSSAI Testing

If an FSSAI officer draws a food sample, the following procedures must be followed during the sample collection process:

Signature of Witnesses

The Food Safety officer should call for one or more witnesses while taking the sample piece and obtain a signature on all related forms and documents.

Notice to the Business Operator

If the product has been obtained from the manufacturer or supplier, a notice in Form V-A shall be issued to them. When a product is drawn from an open container, the person drawing the sample should draw another sample from a container in its original condition bearing the same declaration and intimate the same to the Food Analyst.

Payment for the Sample

The Food Safety Officer should pay the cost of the sample to the person from whom the sample drew it. The price should be calculated at the rate at which the product is sold to the public.

Packing of Sample

The sample food for the analysis should be taken in clean, dry bottles or jars or in a container that should be adequately sealed to prevent leakage, and evaporation and to avoid the entrance of moisture. When selecting an already packed product as a sample, no further sealing is required.

Labeling the Package

The package should be properly labeled and should bear the following requirements:

- Code of the sample
- Name of the sender with his official designation
- Date and place of collection
- Nature of the product that has been sent for analysis
- Nature and quantity of preservative added to the sample

Sealing of package

The sample should be divided into four parts, and each piece should be sealed and wrapped using strong paper. The ends of the form should be folded and affixed. Further, a paper slip that covers the bottom to the top of the container, bearing the signature of the designated officer, should be pasted on the wrapper.

The signature or thumb impression of the person from whom the sample has been taken should be affixed so that the paper slip and the wrapper bear part of the signature or the thumb impression. The paper cover should be further protected by means of a strong thread above and across the jar. The knots of the thread should be covered by wax bearing the impression of the sender’s seal.

Dispatch of the Package

The containers of the samples shall be dispatched in the following manner:

- The sealed container of one part of the sample, along with the memorandum in Form VI should be sent to the Food Analyst.

- The second and third parts of the sample along with two copies of the memorandum in Form VI should be sent to the Designated Officer.

- The fourth part of the sample along with a copy of the memorandum in Form VI should be sent to an accredited laboratory along with the prescribed fee.

On receipt of the food sample, the authorized FSSAI lab would analyze the quality and safety of the sample food product and pass the final decision.

Food Testing Laboratories in India

There are around 600 Food Testing Laboratories in India including all NABL-accredited laboratories, those owned by the private sector, FBOs, state/central government, FSSAI-notified laboratories, etc.

Other than these labs, there is another group of Food Testing Laboratories, which includes small players and a larger pool of food testing labs that exists with the FBOs to carry out tests for raw materials and finished goods.

5. Methods for Food Analysis

From detecting pathogens to driving research and development, food analysis is a multifaceted discipline with a wide range of applications. Scientists rely on state-of-the-art methods to carry out food analysis, both in laboratories and on site in ingredients processing plants, production factories and supermarket storerooms.

Here's a closer look at some of the most popular methods used for food analysis:

1. Mass spectrometry (MS)

MS is one of the most common analytical methods used in food analysis laboratories. The technique is often paired with liquid (LC) or gas chromatography (GC) to enhance results. Depending on the application, MS can also be coupled with capillary electrophoresis (CE) and infrared spectroscopy (IR).

2. Nuclear magnetic resonance (NMR) spectroscopy

NMR spectroscopy uses the magnetic properties of atomic nuclei, usually hydrogen, carbon-13, phosphorus-31 and deuterium, to analyse liquid and solid samples. As a non-destructive method, it's ideal for analysing complex food samples and offers the scope to simultaneously detect and quantify multiple compounds. Scientists also covet NMR for its versatility and high reproducibility.

3. Polymerase chain reaction (PCR)

While PCR testing has become a widely recognised term in the wake of the COVID-19 pandemic, food analysis scientists have been relying on the method for decades. The technique analyses specific DNA sequences and has proved especially useful for identifying animal species in meat products. This helps to prevent food fraud and avoid situations like the highly publicised 2013 horsemeat scandal. PCR testing is also used to detect harmful pathogens and other microorganisms, as well as the presence of genetically modified organisms (GMO).

4. Enzyme-linked immunosorbent assay (ELISA)

From product manufacturers to quality control agencies, ELISA is one of the most widely used methods in the food industry. Tests are used to detect hidden allergenic proteins in food products, including hormones, antibodies and peptides. As a highly-sensitive technique, ELISA is also used to detect peanut traces in raw, processed and cooked foods.

In the dairy industry, ELISA is used to identify pathogens such as E. coli, Salmonella and listeria in milk and cheese products. The testing method is also capable of detecting mould spores before they begin to grow.

5. LFD (lateral flow device)

LFD testing is another method that's been popularised during the pandemic. In the food industry, this immunological assay technique is a fast and efficient way to detect gluten in products, with an antigen-antibody reaction used to identify the protein. The latest LFD testing kits are compact and easy to use, making them ideal for on-site testing.