Dear viewers, Namaskar

Welcome to the lecture series on Food technology

Today the topic HACCP and ISO concepts for food industries shall be discussed under the following sub headings

1. **Introduction**

2. **HACCP concept**

3. **HACCP Program Prerequisites**
4. **HACCP Preliminary Tasks and Principles**

5. **ISO concept**

6. **Important ISO standards related to food safety**

1. Introduction

HACCP (Hazard Analysis and Critical Control Points), ISO (International Organization for Standardization) and TQM (Total Quality Management) have become commonplace in the food industry. Everyone seems to have views on what should and should not be required of the industry.

Food companies today cannot afford to operate without a comprehensive quality assurance (QA) program, which addresses the critical areas of food safety, and an HACCP and ISO program is essential in today's manufacturing climate.

Traditional quality control programs spot-checked manufacturing conditions, and randomly sampled and tested final products to ensure safe food. If the finished product met the specifications, it was approved; otherwise, the product was held, reprocessed, or destroyed. This approach of course was reactive rather than preventive, and was inefficient.

The ideas behind a QA program in general, and an HACCP program in particular, are about preventive systems — to eliminate a problem before it happens. The actions that these systems provoke are essentially preclusive — they are designed to prevent problems rather than solve them after they have occurred. Quality control (QC) checks occur during the process so that a finished product is deemed consistently safe.

2. HACCP (Hazard Analysis and Critical Control Points)

HACCP is an industry-wide effort approved by the scientific, as well as by the regulatory and industry communities, designed to focus on food safety, including food safety in retail establishments. A major focus of the HACCP program is "from farm to table." In this context HACCP is a concept as well as a method of operation, applied to all phases of food production, including agricultural production, food handling, food processing, food services, food distribution, and consumer use. In short, everyone is responsible for safe food products. When it comes to pathogens, "sight, smell, and taste" is not enough. It is necessary to have control over the process, the raw materials, the environment, and the people, beginning as early in the food production system as possible.

HACCP offers a number of advantages. Most important, the program:

1. Focuses on identifying and preventing hazards from contaminating food, based on sound science.
2. Permits more efficient and effective government oversight, primarily because record keeping allows investigators to see how well a firm is complying with food safety laws over a period, rather than how well it is doing on any given day.
3. Places responsibility for ensuring food safety on the food manufacturer or distributor.
4. Helps food companies to compete more effectively in the world market.
5. Reduces barriers to international trade.

In the application of HACCP, the use of microbiological testing is seldom an effective means of monitoring Critical Control Points (CCPs), because of the time required to obtain results. In most instances, monitoring of CCPs can best be accomplished through the use of physical and chemical tests, and through visual observations. Microbiological criteria do, however, play a role in verifying that the overall HACCP system is working.

3. HACCP Program Prerequisites

The production of safe food products requires that an HACCP program be built upon important prerequisites. The following are examples of common prerequisites.

- **Facilities.** The establishment should be located, constructed, and maintained according to sanitary design principles. There should be linear product flow and traffic control to minimize cross-contamination from raw to cooked materials.
- **Supplier Control.** Each facility should assure that its suppliers have in place effective Good Manufacturing Practice (GMP) and food safety programs. These may be the subject of continuing supplier guarantee and supplier HACCP system verification.
- **Specifications.** There should be written specifications for all ingredients, products, and packaging materials.
- **Production Equipment.** All equipment should be constructed and installed according to sanitary design principles. Preventive maintenance and calibration schedules should be established and documented.
- **Cleaning and Sanitation.** All procedures for cleaning and sanitation of the equipment and the facility should be written and followed. A master sanitation schedule should be in place.
- **Personal Hygiene.** All employees and other persons who enter the manufacturing plant should follow the requirements for personal hygiene.
- **Training.** All employees should receive documented training in personal hygiene, GMPs, cleaning and sanitation procedures, personal safety, and their role in the HACCP program.

- **Chemical Control.** Documented procedures must be in place to assure the segregation and proper use of nonfood chemicals in the plant. These include cleaning chemicals, fumigants, and pesticides or baits used in and around the plant.
- **Receiving, Storage, and Shipping.** All raw materials and products should be stored under sanitary conditions and the proper environmental conditions, such as temperature and humidity, to assure their safety and wholesomeness.
- **Traceability and Recall.** All raw materials and products should be lot-coded and a recall system in place so that rapid and complete traces and recalls can be done when a product retrieval is necessary.
- **Pest Control.** Effective pest control programs should be in place.

Other prerequisite programs include:

- Quality assurance procedures
- Standard operating procedures for sanitation, processing, product formulations and recipes
- Glass control
- Procedures for receiving, storage, and shipping
- Labeling
- Employee food and ingredient handling practices

4. The Preliminary Tasks of an HACCP Program

The preliminary tasks in the development of an HACCP plan are summarized below.

Choosing the HACCP Team: The team's responsibility is to develop the HACCP program. The HACCP team must be composed of individuals with specific knowledge of the product characteristics and expertise appropriate to its manufacturing process, and its variability and limitations, including individuals from areas such as engineering, production, sanitation, QA, analytical/food microbiology, and

personnel involved in the manufacturing operation itself. This fosters a sense of ownership among those who must implement the program.

Description of the Food Product and Its Distribution: The HACCP team must be able to describe the food product. This includes a general characterization of it, its ingredients, and the processing and manufacturing methods. The method of the product distribution should
also be described, along with information on whether the food is to be distributed frozen, refrigerated, or at ambient temperature, as well as the storage requirements.

Description of the Intended Use and Consumers of the Product: A description of the normal expected use of the food product should be outlined. The intended consumers may be the general public or a particular segment of the population, e.g., infants, immunocompromised individuals, the elderly, etc.

Development of a Flow Diagram Describing a Food Product Manufacturing Process: A flow diagram provides a clear, simple outline of the steps involved in the manufacturing process. The flow diagram should cover all the steps in the manufacturing process, which are directly under the control of the manufacturing plant. It can also include steps in the food chain, before and after processing, which occur in the plant.

Verification of the Flow Diagram: Once the previous tasks have been completed, the HACCP team should perform an on-site review of the manufacturing operation to verify the
accuracy and completeness of the flow diagram. For example, where there are considerable amounts of raw materials, processing equipment such as receiving stations or conveyors, or inspection and testing prior to processing, it may be wise to break out that processing step into a separate flow diagram for clarity and accuracy in hazard analysis review.

The seven HACCP principles

Principle 1: Conduct a Hazard Analysis

After addressing the preliminary tasks discussed above, the HACCP team must conduct an analysis with the purpose of developing a list of hazards — biological, chemical, or physical — reasonably likely to cause injury or illness if not effectively controlled. When conducting a hazard analysis, considered by many to be the foundation of an HACCP plan, *safety* concerns must be differentiated from *quality* concerns. The word hazard, as used in this context, is related to safety. A thorough hazard analysis is key in the preparation of an effective HACCP program.

Principle 2: CCP Identification
In addition to determining potential hazards, HACCP programs identify the points in the food-manufacturing process where these hazards can best be controlled. Potential hazards that are reasonably likely to cause illness or injury in the absence of their control must be addressed in determining CCPs. Complete and accurate identification of CCPs is fundamental
to controlling food safety hazards.

Principle 3: Establish Critical Limits for Each CCP
Once CCPs are identified, critical limits are determined to reduce or eliminate potential hazards.

Principle 4: Establish CCP Monitoring Procedures
Monitoring consists of a planned sequence of observations or physical measurements that can be readily recorded at each CCP to ensure that the process is under control without imposing unrealistic time delays or costs in production. Monitoring provides an early warning that a process is either losing control or is, in fact, out of control. Monitoring procedures can be
carried out continuously, using many types of physical and chemical instruments such as temperature recorders, pressure recorders, or pH recorders that will provide information upon which decisions and appropriate actions are taken when critical limits are exceeded.

Principle 5: Establish Corrective Actions Procedures

Once hazards have been identified, critical limits determined, and monitoring procedures set up, it is important to have pre-established corrective actions to eliminate the deviations and permit production to proceed. Corrective actions are defined as "actions to be taken when the

results of monitoring at the CCPs indicate a loss of control." The HACCP plan must be designed so that deviations from the critical limits can be discovered quickly, allowing for detection and subsequent elimination or reduction of deviations by corrective actions taken as early as possible.

Principle 6: Establish Procedures for HACCP Verification and Validation

Although verification appears to consist simply of checking for instrument calibration and the reviewing of records, this process embodies additional activities that ensure the validity of an HACCP program and includes review of CCP records, critical limits, and microbial sampling and analysis procedures.

Validation ensures that the program does what it was designed to do; i.e., succeed in ensuring the production of a safe product. A scientific or technical review of the critical limits is necessary to verify that the specifications that are set are adequate to control the hazards that are likely to occur, and in some cases that the specifications comply with regulatory requirements. Food manufacturing plants are required to validate their own HACCP programs.

Principle 7: Document the HACCP Program. Establishment of Record-Keeping Procedures

An HACCP program should be thoroughly documented and implemented establishing procedures for the identification, storage, retrieval, maintenance, protection, and disposition of documents. The documentation generated must be formal written records providing factual evidence that an activity has been performed in a timely manner in accordance with established procedures.

Over all, HACCP is a simple system to follow. It concentrates on critical hazards helping to prevent foodborne illness.

Manufacturing plant management should conduct an in-depth audit of the entire HACCP system at least once a year and whenever there are new products, new manufacturing lines, or new processes. Each of these requires a new HACCP program.

Customers may add potential safety problems, depending on how they handle and store the food they buy, particularly at ready-to eat locations. This could be considered a last CCP to deal with.

5. International Organization for standardization (ISO)

ISO (International Organization for Standardization) is the world's largest developer of voluntary International Standards providing benefits for business, government and society. ISO is a network comprising the national standards institutes of 163 countries. ISO standards make a positive contribution to the world we live in. They ensure vital features such as quality, ecology, safety, reliability, compatibility, interoperability, efficiency and effectiveness – and at an economical cost. They facilitate trade, spread knowledge, and share technological advances and good management practices.

Today more than ever, food products regularly cross national boundaries at every stage of the supply chain, from farm to fork. ISO International Standards create confidence in the products we eat or drink by ensuring the world uses the same recipe when it comes to food quality,
safety and efficiency. ISO provides a platform for developing practical tools through common understanding and cooperation with all stakeholders on board, from agricultural producers, to food manufacturers, laboratories, regulators, consumers, etc. Working through its network of national members, its standards bring together the foremost expertise in the world and disseminate it to both developed and developing countries. ISO standards are powerful tools for taking action on global challenges like sustainability and climate change by for example, disseminating best practice on new

technologies less detrimental to the environment. By implementing voluntary ISO standards, companies make a proactive commitment to the principles they stand for: quality, transparency, accountability and safety.

6. Important ISO standards related to food safety

1. ISO 9000: Quality Management Standard
2. ISO 14000: Environmental Management Standard
3. ISO 22000: Food Safety Management Standard
4. ISO 17025: Laboratory Management Standard.

ISO 9001:2000 Quality Management Systems (QMS): This is one of the standards in the ISO 9000: Quality Management family of standards. It specifies requirements for a quality management system where an organization needs to demonstrate its ability to consistently provide products that meet customer and applicable regulatory requirements. ISO 9001:2000 QMS places emphasis on customer satisfaction and is recognized worldwide as an effective tool for facilitating regional and international trade because products produced by an organization certified to the ISO QMS have higher perceived quality in the market and therefore gives an implementing firm a competitive advantage in the market.

ISO 9001: 2008: is part of ISO 9000 family of standards that sets out the criteria for a
quality management system. The standard is based on a number of quality management principles including a strong customer focus, the motivation and implications of top management, the process approach and continual improvement. Application of the standard ensures that customers get consistent good quality products and services, which in turn brings many business benefits. Audits that are important part of the standard are meant to check that the system works. An organization must perform internal audits to check how its quality management system is working.

ISO 22000: Food Safety Management Standard

ISO 22000 family of international standards addresses food safety management. The standard helps organizations to identify and control food safety hazards. Due to the enhanced international trade in food products, international standards are needed to ensure the safety of global food supply chain.

ISO 22000: 2005 contains the overall guidelines for food safety management and sets out the requirements for a food safety management system. It maps out what an organization needs to do to demonstrate its ability to control food safety hazards in order to ensure that food is safe. It can be used by any organization regardless of its size or position in the food production chain.

ISO 22005: 2007 focuses on traceability in the feed and food chain. It gives the principles and specifies the basic requirements for the design and implementation of a feed and food traceability system. It can be applied by any organization operating at any step in the feed and food production chain.

ISO/TS 22002-1: 2009 specifies requirements for establishing, implementing and maintaining programs to assist in controlling food safety. The standard is applicable to organizations involved in food manufacturing. Food manufacturing operations are diverse in nature and not all of the requirements specified in this standard apply to any individual establishment.

The standard specifies detailed requirements considered in relation to food manufacturing including:

a) Construction and layout of buildings and associated utilities
b) Layout of premises, including work space and employee facilities
c) Supplies of air, water, energy and other utilities
d) Supporting services, including waste and sewage disposal
e) Suitability of equipment and its accessibility for cleaning maintenance and preventive maintenance
f) Management of Purchase materials

g) Measures for the prevention of cross-contamination
h) Cleaning and sanitizing
i) Pest control
j) Personal hygiene
k) Re-work of products
l) Recall procedure
m)   Warehousing
n) Product information and consumer awareness
o) Food defense, bio-vigilance and bioterrorism

ISO/TS 220022-3: 2011 specifies requirements and guidelines for the design, implementation and documentation of requisite programs that maintain a hygienic environment and assist in controlling food safety hazards in the food chain. The standard is applicable to the farming of crops (e.g. cereals, fruits vegetable,) living farm animals (e.g. cattle, poultry, pigs and fish) and the handling of their products (e.g. Milk, meat and eggs). All operations related to farming are included in the scope (e.g. sorting, cleaning, packing of unprocessed products, on-farm feed manufacturing and transport within the farm).

ISO 14000: Environmental management standard

The ISO 14000 family addresses various aspects of environmental management. It provides practical tools for companies and organizations looking to identify and control their environmental performance. ISO 14001:2004 and ISO 14004: 2004 focuses on environmental management systems. ISO 14001: 2004 sets out the criteria for an environmental management system and its use provides assurance to a company management and employees as well as stakeholders that environmental impact is being measured and improved.

The benefits of using ISO 14001:2004 standard include:

1. Reduced cost of waste management
2. Savings in consumption of energy and materials
3. Lower distribution costs

4. Improved corporate image among regulators, customers and the public.

Benefits of ISO standards

1. They ensure that products and services are safe, reliable and of good quality.
2. They are strategic tools for minimizing waste and errors,
3. They increasing productivity and enhance customer satisfaction.
4. They level playing fields for developing countries and facilitate free and fair trade.
5. They breaking barriers to international trade which assist food companies access new markets,
6. They help to harmonize technical specifications of products and services making industry more efficient

Conclusion: HACCP and ISO food standards create confidence in the products we eat and drink. Their food standards provide benefits for all participants in the supply chain, from farm to transportation and logistics, from manufacturing to retailing and services, from consumers to regulators and analytical laboratories. HACCP and ISO bring all stakeholders on board to share best practice, promote state-of-the-art technology, and ensure safety and quality. Conformity to the above international standards helps reassure consumers that products are safe, efficient and good for the environment.