

### **Lecture 1: Overview of Bioproducts Safety and Risks**

- Safe bioproducts and safety definition: the principles behind defining a bioproduct as safe, including regulatory and practical definitions.
- Characterisation of food hazards: the three major types of hazards—physical, chemical, and biological—that affect bioproduct safety, with examples from industry.
- Microbial risk and dose-response modelling: dose-response modelling to evaluate microbial risks and their impacts on consumers.
- Exposure and dose-response modelling of chemical hazards: how chemical hazards are evaluated using exposure and dose-response modelling.
- History of bioproduct safety: a historical overview of key milestones in bioproduct safety, focusing on regulations and technological developments.

### **Lecture 2: Physical and Chemical Hazards**

- Metals, mineral (soil, engine oil, stones), irradiation: the range of physical hazards that can contaminate bioproducts, both naturally occurring and those introduced during processing.
- Hazards produced during food processing, storage, and preparation: the potential for chemical and physical hazards introduced during production and storage.
- Hazards associated with nutrient fortification: how nutrient fortification can sometimes introduce risks and how they can be mitigated.
- Hazards resulting from environmental, industrial, and agricultural contaminants: contaminants from external sources, including pollutants introduced during the agricultural phase of production.

### **Lecture 3: Biological Hazards**

- Prevalence of foodborne pathogens: common pathogens like *Salmonella*, *Listeria monocytogenes*, and *Escherichia coli* and their role in foodborne illness.
- Physiology and survival of foodborne pathogens in various food systems: how foodborne pathogens survive and thrive in various types of bioproducts.
- Characteristics of biological hazards in foods: the features of biological hazards such as bacteria, viruses, and parasites.
- Contemporary monitoring methods: modern techniques like PCR and biosensors for detecting pathogens in bioproducts.

### **Lecture 4: Naturally Occurring Contaminants and Inherent Toxicants of Plant Origin**

- Phycotoxins: marine biotoxins, their occurrence in seafood, and their impact on food safety.
- Mycotoxins: fungal toxins such as aflatoxins and their effects on agricultural products like grains and nuts.
- Inherent plant toxins: naturally occurring toxins in plants, including alkaloids and glycoalkaloids, and how they can affect food safety.
- Toxic mushrooms: common toxic mushrooms, their potential risks in food systems, and the importance of proper identification.
- Toxicology and occurrence: an overview of the toxicology of these naturally occurring substances and where they are commonly found.
- Risk assessment: methods for assessing the risks associated with natural toxins in bioproducts.
- Risk management: strategies for controlling and mitigating risks associated with these contaminants.

### **Lecture 5: Allergens and Practice of Allergen Management**

- Food allergy/intolerance: difference between food allergies and intolerances, particularly in bioproduct safety.

- Mechanisms of IgE-mediated food allergy: the immune response in IgE-mediated food allergies, with examples from common allergens in bioproducts.
- Evolution of regulatory allergen lists across the world: how global regulations on allergens have evolved and the importance of harmonizing these rules in bioproduct industries.
- Best practices in allergen management: guidelines for preventing cross-contamination and ensuring accurate allergen labeling in bioproduct manufacturing.

### **Lecture 6: Microbial Contamination Control in Bioproducts**

- Introduction to microbial contamination: overview of microbial risks in bioproducts, including bacteria, fungi, and viruses.
- Sanitation techniques in production: best practices for sanitation in bioproduct production environments to control microbial contamination.
- Antimicrobial strategies: physical and chemical strategies for preventing microbial growth (e.g., heat treatment, preservatives).
- Control of spoilage microorganisms: how to manage spoilage organisms that affect the shelf life and safety of bioproducts.
- Monitoring and testing microbial load: methods for monitoring microbial contamination levels throughout the production process.

### **Lecture 7: HACCP and Food Safety Management Systems**

- Introduction to HACCP principles: overview of the Hazard Analysis and Critical Control Points (HACCP) system and its role in ensuring bioproduct safety.
- Designing a HACCP plan: step-by-step guide to creating a HACCP plan, with examples from the bioproduct industry.
- Identifying Critical Control Points (CCPs): how to identify and manage critical control points to prevent hazards during production.
- HACCP in bioproducts: practical applications of HACCP for specific bioproducts like fermented foods, probiotics, and beverages.
- Verification and documentation procedures: ensuring HACCP systems are implemented correctly through verification and record-keeping.

### **Lecture 8: ISO Standards and Certifications in Bioproduct Safety**

- Introduction to ISO 9000 and ISO 22000: overview of ISO standards related to quality and safety management in bioproducts.
- ISO certifications for bioproduct safety: obtaining ISO certifications and their relevance to global markets.
- Implementation of ISO standards: best practices for implementing ISO 9000 and 22000 in bioproduct manufacturing.
- Integration of ISO with other quality management systems: how to integrate ISO standards with other safety management frameworks like GMP and HACCP.
- Audit and compliance processes: guide to conducting internal audits to ensure compliance with ISO standards.

### **Lecture 9: Safety in Bioproduct Packaging and Distribution**

- Contamination risks during packaging: overview of contamination risks during the packaging stage and how to mitigate them.
- Packaging materials and safety standards: discussion on the selection of safe packaging materials, including biodegradable and eco-friendly options.
- Packaging and labeling requirements: overview of regulatory requirements for packaging and labeling, including safety warnings and allergen statements.
- Ensuring safety during distribution: maintaining bioproduct safety during transportation and storage, including temperature control and sanitation.

- Emerging trends in packaging safety: innovations in bioproduct packaging to enhance safety, such as active packaging materials.

### **Lecture 10: Case Study: Failures in Bioproduct Safety**

- Introduction to case studies of safety failures: high-profile bioproduct safety failures and their consequences.
- Root cause analysis: techniques for analyzing the root causes of safety failures and preventing future incidents.
- Lessons learned from bioproduct safety failures: key takeaways from case studies to improve safety management practices.
- Rebuilding consumer trust: how companies recovered from safety failures and strategies to rebuild trust.
- Role of regulators in safety failures: how regulatory bodies responded to safety failures and their role in mitigating risks.

### **Lecture 11: Biotechnology Tools for Ensuring Bioproduct Safety**

- Role of biotechnology in safety management: overview of how biotechnology is applied to improve bioproduct safety.
- Biosensors and rapid detection tools: the use of biosensors and molecular techniques for real-time safety monitoring.
- Biopreservation methods: bacteriocins and probiotics, to enhance product safety.
- Future trends in biotechnology for safety: emerging biotech tools for improving safety in bioproduct production and distribution.

### **Lecture 12: Managing Safety in Fermented Bioproducts**

- Fermented bioproducts and safety concerns: overview of safety risks specific to fermented bioproducts like dairy, beverages, and probiotics.
- Hygiene in fermentation processes: sanitation and hygiene practices in fermentation facilities to control contamination.
- Microbial starter cultures: role of microbial starter cultures in ensuring product consistency and safety.
- Managing spoilage and pathogen risks: techniques to prevent spoilage and pathogenic contamination in fermented products.
- Regulatory oversight of fermented bioproducts: regulations governing fermented foods and beverages.

### **Lecture 13: Personalization in Probiotics and Synbiotics**

- Introduction to personalized probiotics: growing trend of personalized probiotics and their safety considerations.
- Safety protocols for synbiotics: safety management systems required for synbiotic products (combination of probiotics and prebiotics).
- Regulatory challenges in personalized bioproducts: regulatory hurdles in bringing personalized probiotics and synbiotics to the market.
- Consumer trends in personalization: overview of consumer demand for personalized products and how this influences safety management.
- Future directions for personalized bioproducts: potential innovations and future trends in personalized bioproducts.

### **Lecture 14: Innovations in Bioproduct Safety Management**

- Emerging technologies for safety management: overview of new technologies like blockchain, AI, and IoT for tracking and ensuring bioproduct safety.
- Smart packaging and safety: how smart packaging revolutionizes safety management in bioproducts by providing real-time data on product conditions.

- Data-driven approaches to safety: big data and predictive analytics to forecast and prevent safety issues.
- Automation in safety management: how automation is being integrated into bioproduct production lines to enhance safety monitoring.
- Innovations in regulatory compliance: how technology is helping companies stay compliant with evolving safety regulations.

### **Lecture 15: Climate Change and Food Safety**

- Possible impact of Climate Change on microbial hazards.
- Possible impact of Climate Change on chemical hazards.
- Contribution of food production on Climate Change.