

## MODULE 3: Safety and Quality Assurance in Food Processing Industry

### COURSE TITLE: 3.1 FOOD SAFETY ISSUES AT MANUFACTURING PROCESSES

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## CREDITS: 3 (3-0-6)

1 credit: 1 h/week (15 h)

(Lecture-Practice-Self learning)

Class (contact hours): 45 H (15 weeks)

Self-learning (Assignment, Presentation, Case study, Self study): 90 H (15 Weeks)

TOTAL: 135 H/SEMESTER (15 Weeks)

## LANGUAGE OF COURSE DELIVERY:

ENGLISH or FRENCH, and national languages (THAI, VIETNAMESE, KHMER)

## WORKLOAD: 135H

(/25h=5 ECTS): 45 contact hours + 90h self learning (1 credit=15h)

Semester:

## PREREQUISITES: MICROBIOLOGY, CHEMISTRY, FOOD TECHNOLOGY

## COURSE OBJECTIVES

To provide the students with knowledge on the key food safety issues, including the food safety hazards, their sources and methods of control. The course will also deal with the basic needs for processing, storage and food handling activities from raw materials and goods inwards through manufacturing, packing, storage including pest control, cleaning, disinfection and waste management.

## LEARNING OUTCOMES

Upon completion of this course, students will:

**L01:** have an understanding of a wide range of key food safety issues, including the food safety hazards, their sources and methods of control.

**L02:** be familiar with the current and future implications concerning food safety hazard and risks.

**L03:** understand the basic needs for processing and for storage and food handling activities from raw material and goods inwards through manufacturing, packing and warehouse storage

**L04:** understand the principles of waste minimization and carbon foot print in food industries

**L05:** be aware of common food pests and apply the methods to control

**L06:** understand the principles, actions, and limitations of cleaning and disinfection and how these apply to the workplace.

**L07:** be able to identify hygienic risks in food production units and to make proposals for designing to avoid the hazards

**L08:** be able to research a topic, synthesis current information and develop a presentation related to safety and quality assurance in food industry

Benchmark LOs	Knowledge	Skills	Competence	Suggested EQF levels
LO1	X			6
LO2	X			6
LO3	X			6
LO4	X			6
LO5	X	X		7

LO6	X	X	X	7
LO7		X	X	7
LO8		X	X	7

## COURSE OUTLINE

The course includes:

- Introduction to Food Safety and Hygiene
- Food-borne Illnesses – overview on food-borne illnesses and how they affect consumers
- Food Safety Hazards and Contamination during processing – exploring food safety hazards and how they arise and consider how they can be prevented and controlled.
- Food Preservation - how to preserve food, including appropriate storage and temperature controls, emerging technologies.
- Personal Hygiene – covering hand washing, health, first aid, protective clothing and appearance.
- Hygienic Premises and Equipment – cover good housekeeping and the part premises and equipment design in maintaining clean, pest-free conditions, including air and water related aspects.
- Principles of waste minimization, recovery and reuse of active ingredients
- Principles of Life Cycle Assessment (LCA) in food industries towards sustainability

### 1. Introduction and Overview:

Hygiene and Food Safety Issues in Food processing

### 2. Hazards

#### 2.1. Biological Hazards

Food-borne Illnesses – overview on food-borne illnesses and how they affect consumers, Foodborne Pathogens, Emerging pathogens and issues; their roles in contaminations at various stages

Types of microorganisms; Source; Entry routes in food systems;

Toxins generated from microorganisms such as endotoxins, neurotoxins

Preventive measures

Detection methods

- **Case studies in food, beverage industries**

#### 2.2. Physical Hazards

Foreign particles in raw materials, Inclusion of foreign particles during processing, packaging, storage and handling.

Preventive measure and detection methods

#### 2.3. Chemical Hazards and Allergens

Contaminants; Toxins, Residues,

Allergens

Adulterants:

Detection methods

### 3. Good Hygiene Practice/

#### 3.1. Terminology and Definition

#### 3.2. Personal Hygiene

#### 3.3. Hygienic design of building and equipment

### 3.4. Cleaning and Disinfection

Definitions

Soiling and Fouling: Inorganic (Scaling), Organic, Biofouling (Biofilm)

Principles and mechanisms of cleaning and disinfection; Methods (COP: Foam, pigging., CIP) and their Modes of action

Cleaning and Disinfection agents and their proper use, modes of action and handling

] Cleaning validation

### 3.5. Pest Control

Definitions, Types of pest; behaviour

Pest control systems in food and beverage industries

Validation methods

#### ***Two case Studies: One relevant to operational procedures and other on validation methods***

*Case study1: Cleaning and sanitary processes Standard Sanitation Operating Procedure (SSoPs)*

*Case study2: CIP for dairy and/or beverage industries*

*Case study3: Cleaning validation methods (e.g. SWAB method) in industrial processes for residues*

*Case study4: Contamination/Recontamination of food borne pathogens during and/or after product development*

## 4. Water safety

Types of water and specifications: ingredient water, ice, utility water (steam and water used in cleaning and fire protection)

Water Quality standard (International guidelines)

## 5. Waste Minimization

Types and Impact of waste (food and/or industrial waste)

Waste Minimization,

Issues of reuse of waste and recovered active ingredients and validation

Hygiene and control measures

## 6. Food preservation

Definitions; Food and Biosafety measures and quantification

Principles of Hurdle technologies. Various methods and their importance

Innovative technologies

One Case study: Relevant to Food preservation, innovative adopted technologies and effects

Case study: related to Hurdle technologies in food processing industries

Case Study: Contamination/Recontamination of Non-thermal or minimal thermally processed foods.

Case study: Contamination/Recontamination during various storage conditions of food products

## 7. Life Cycle Assessment and Carbon Footprint

Life Cycle assessment (LCA) and its role in production of food and beverage at the industry

Emission of carbon during food production systems; Impact assessment of carbon production in food and beverage industries;

## LABORATORY SESSION: NONE

**Learning Outcomes (LOs)- Course Content Matrix**

		1	2	3	4	5	6	7
	LO1	X	X		X			
	LO2		X	X				
	LO3			X	X			
	LO4				X	X	X	X
	LO5			X				
	LO6			X				
	LO7			X				
	LO8			X		X	X	

**Skills Development Matrix**

<b>Skills (Discipline specific)</b>	
Food-related hazards	I
Hazard analysis	IP
Hygienic practices	IPA
Cleaning and Disinfection design	IPA
Water and waste handling	IP
Preservation methods	IP
<b>Transferable Skills</b>	
Independent learning	P
Time management	P
Oral communication	PA
Written Communication	PA
Co-operative learning	P
Leadership	P

**Outcome-Method Table**
**Intellectual Outcomes**

Intellectual outcomes	Teaching methods or activities
Students will be better able to:	
1. Identify, investigate and critically evaluate current issues in food safety and preventive strategy to reduce hazards	Classroom lecture, case studies, webinar, factory visits, on-line tutorial
2. Identify and critically evaluate food safety hazards in food operation and production	Classroom lecture, case studies, webinar, factory visits, on-line tutorial
3. Critically evaluate the raw materials including water and industrial food waste to minimize the food safety hazards	Classroom lecture, case studies, webinar, factory visits, on-line tutorial

**Skills Outcome**

Skills outcome	Teaching methods or activities
Students will demonstrate the ability to:	
1. Apply the relationship between hygienic conditions, disinfection and cleaning procedures	Classroom lecture, case studies, webinar, factory visits, on-line tutorial

2. Apply the hygienic concepts and design to reduce/eliminate the food hazards and pests	Classroom lecture, case studies, webinar, factory visits, on-line tutorial
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### Attitudinal Outcome

Attitudinal outcomes	Teaching methods or activities
Students will increasingly be able to:	
1.systemically search, select and evaluate the literature and other relevant materials on food safety	Case studies, factory visits, on-line directed self-learning, Group study
2. Plan and manage to do the research and identify issues related to food safety in the industries	Case studies, factory visits, on-line directed self-learning, Group study
3. Be responsible towards food safety	Case studies, factory visits, on-line directed self-learning,

### Learning Resources:

**Textbooks:** No designated textbook, but class notes and handouts will be provided.

### Reference Books:

1. Evans, L. T. (1993). *Crop Evolution and Yield*. Cambridge University Press.
2. Kropff, K.J. (1997). *Application of Systems Approaches at the Field Level*. Kluwer Academic Publisher, The Netherlands.
3. Debby N. (2013). *Food Safety Management Programs: Applications, Best Practices and Compliance*, CRC Press, UK and USA.
4. Yasmine M., & Hubb, L. (2013). *Food Safety Management: A Practical Guide to the Industry*. Elsevier.

### Journals and Magazines:

1. Food Control, Elsevier
2. Food Policy, Elsevier
3. Food Research International, Elsevier
4. Industrial Crops and Products, Elsevier
5. Postharvest Biology and Technology, Elsevier
6. Innovative Food Sciences and Emerging Technologies, Elsevier
7. Trends in Food Science and Technology, Elsevier
8. Journal of Food Safety, John Wiley & Sons

## TEACHING AND LEARNING METHODS

The course is delivered via lectures, webinars, reading materials including the recent literatures and practical problem solving in food safety issues. . Additional online and recent information will be provided to enhance self-learning experiences. Active learning is encouraged and students' understanding of each modules or subtopics is evaluated via featured examples, practical questions, relevant case studies, homework and presentation. .

Time Distribution and Study Load:

1. Lecture: 45 hours

2. Assignments: 15 h
3. Case study and presentation : 40 h
4. Self study: 35 hours

## EVALUATION SCHEME

The final grade will be based on the following weight distribution: Assignments (15%), Case studies and presentation (35%) mid semester exam (20%) and final exam (30%)

An “A” would be awarded if a student can show the ability having elaborative knowledge on; elaborate, formulate and solve problems related to this module. A “B” would be awarded if a student shows an overall understanding of the topics covered, a “C” would be given if a student meets below expectation on both knowledge acquired and analysis. A “D” would be given if a student does not meet basic expectations of the topics presented in the course.

### Assessment Specification Grid

Activities	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	Total
Assignment1	1	2	2					2	7
Assignment2							5	3	8
Case study1				3	2	3	3	3	14
Case study 2				3	2	3	2	2	12
Case study 3			4					5	9
Examination	5	5	10	5	10	10	5	-	50
Total	6	7	16	11	14	16	15	15	100

### Assessment of Case study and Assignments:

- Understanding the concept and topics properly
- Demonstrate the specifically sound of the evident-based case analysis
- Concise reviewing the relevant literature on relevant topics
- Interpret the acquired data and analyze scientifically
- Describe the results comprehensively and writing skills in the report
- Clear oral presentation

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## ALIGNMENT MATRIX OF MODULE LEARNING OUTCOMES

Corresponding EQAS LO	Module LO	Units developing the LO	Extent of alignment with EQAS LO (maximum total for an EQAS LO 100%)
<b>Learning Outcomes for Food Safety and Microbiology</b>			
Describe the properties of common food spoilage organisms. Experimentally determine their presence and numbers. Demonstrate a critical understanding of instances of food spoilage, causation and prevention.	LO1: have an understanding of a wide range of key food safety issues, including the food safety hazards, their sources and methods of control.		
	L02: be familiar with the current and future implications concerning food safety hazard and risks.		
Describe the properties of common food poisoning organisms, their toxins and means of detection. Experimentally determine the presence of food poisoning organisms. Demonstrate a working knowledge of food-borne infections/intoxications, evaluating causation and prevention.	LO1: have an understanding of a wide range of key food safety issues, including the food safety hazards, their sources and methods of control.		
	L02: be familiar with the current and future implications concerning food safety hazard and risks.		
	L05: be aware of common food pests and apply the methods to control		
	L06: understand the principles, actions, and limitations of cleaning and disinfection and how these apply to the workplace		
Recognize and describe the principles and limitations of food preservation. Exercise appropriate judgment on the suitability of different preservation methods to particular foods; give some practical examples. Critically discuss the effects of intrinsic and extrinsic factors on shelf-life and safety of foods. Give practical examples and some indications of the benefits of predictive modelling.	L03: understand the basic needs for processing and for storage and food handling activities from raw material and goods inwards through manufacturing, packing and warehouse storage		
	L06: understand the principles, actions, and limitations of cleaning and disinfection and how these apply to the workplace		
	L07: be able to identify hygienic risks in food production units and to make proposals for designing to avoid the hazards		
<b>Learning Outcomes for Food Chemistry and Analysis</b>			
Demonstrate understanding of the basic concepts of organic chemistry, physical chemistry and biochemistry related to food. Demonstrate an understanding of the structure and function of major food components.	LO1: have an understanding of a wide range of key food safety issues, including the food safety hazards, their sources and methods of control.		
	Describe the physical and chemical properties of foods in production and supply chains. Demonstrate a comprehensive understanding of the	L02: be familiar with the current and future implications concerning food safety hazard and risks.	



Corresponding EQAS LO	Module LO	Units developing the LO	Extent of alignment with EQAS LO (maximum total for an EQAS LO 100%)
structure, function and interactions of major and minor food components, vitamins, flavours, taste and colour.	L03: understand the basic needs for processing and for storage and food handling activities from raw material and goods inwards through manufacturing, packing and warehouse storage		
Describe the effects of at least two different food process operations on the physico-chemical properties of foods. Demonstrate a critical understanding of the changes occurring during food process operations on the physico-chemical properties of foods.	L03: understand the basic needs for processing and for storage and food handling activities from raw material and goods inwards through manufacturing, packing and warehouse storage		
	L07: be able to identify hygienic risks in food production units and to make proposals for designing to avoid the hazards		
Demonstrate an awareness of the relationship between food, nutrition and health.	L02: be familiar with the current and future implications concerning food safety hazard and risks.		
	L04: understand the principles of waste minimization and carbon foot print in food industries		
<b>Food processing and engineering</b>			
Identify sources of raw material; explain the variability and the impact on food processing operations. Propose alternative ways of utilization of lower quality raw materials.	L02: be familiar with the current and future implications concerning food safety hazard and risks.		
	L04: understand the principles of waste minimization and carbon foot print in food industries		
Propose solutions for the practical application of the fundamental concepts of mass, heat, and momentum transfer in food processing	L01: have an understanding of a wide range of key food safety issues, including the food safety hazards, their sources and methods of control.		
	L03: understand the basic needs for processing and for storage and food handling activities from raw material and goods inwards through manufacturing, packing and warehouse storage		
	L08: be able to research a topic, synthesis current information and develop a presentation related to safety and quality assurance in food industry		
Explain the principles and current practices of major food processing operations, and understand the effect of processing parameters on product	L02: be familiar with the current and future implications concerning food safety hazard and risks.		

Corresponding EQAS LO	Module LO	Units developing the LO	Extent of alignment with EQAS LO (maximum total for an EQAS LO 100%)
quality. Understand the principles of process control and instrumentation	L03: understand the basic needs for processing and for storage and food handling activities from raw material and goods inwards through manufacturing, packing and warehouse storage		
	L06: understand the principles, actions, and limitations of cleaning and disinfection and how these apply to the workplace		
Demonstrate understanding about characteristics and properties of packaging materials to select appropriate packaging systems for selected applications	L03: understand the basic needs for processing and for storage and food handling activities from raw material and goods inwards through manufacturing, packing and warehouse storage		
Understand current practices in maintenance of plant hygiene through CIP and its relation to GMP, the use of water in processing, and the management of waste streams.	L04: understand the principles of waste minimization and carbon foot print in food industries		
	L06: understand the principles, actions, and limitations of cleaning and disinfection and how these apply to the workplace		
	L07: be able to identify hygienic risks in food production units and to make proposals for designing to avoid the hazards		
<b>Generic Competences Communication abilities, ethics and personal skills</b>			
Able to plan and carry out an experimental investigation under supervision and write a scientific report following standard conventions.	L08: be able to research a topic, synthesis current information and develop a presentation related to safety and quality assurance in food industry		
Communicate scientific ideas through written, oral and visual means in English. Able to discuss these ideas at a higher level.	L07: be able to identify hygienic risks in food production units and to make proposals for designing to avoid the hazards		
	L08: be able to research a topic, synthesis current information and develop a presentation related to safety and quality assurance in food industry		
Evaluating their own achievement by developing a capacity for self-reflection and that of others by participating in peer-review.	L07: be able to identify hygienic risks in food production units and to make proposals for designing to avoid the hazards		
	L08: be able to research a topic, synthesis current		

Corresponding EQAS LO	Module LO	Units developing the LO	Extent of alignment with EQAS LO (maximum total for an EQAS LO 100%)
	information and develop a presentation related to safety and quality assurance in food industry		
Demonstrate autonomy, self-direction, initiative and effective decision making in complex and unpredictable situations.	L06: understand the principles, actions, and limitations of cleaning and disinfection and how these apply to the workplace		
	L07: be able to identify hygienic risks in food production units and to make proposals for designing to avoid the hazards		
	L08: be able to research a topic, synthesis current information and develop a presentation related to safety and quality assurance in food industry		