



Universitat de Lleida

DEGREE CURRICULUM

FOOD MICROBIOLOGY

Coordination: RAMOS GIRONA, ANTONIO JAVIER

Academic year 2020-21

Subject's general information

Subject name	FOOD MICROBIOLOGY		
Code	102583		
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION		
Typology	Degree	Course	Character
	Bachelor's Degree in Agricultural and Food Engineering	3	COMPULSORY
			Modality Attendance-based
Course number of credits (ECTS)	6		
Type of activity, credits, and groups	Activity type	PRALAB	TEORIA
	Number of credits	2.7	3.3
	Number of groups	1	1
Coordination	RAMOS GIRONA, ANTONIO JAVIER		
Department	FOOD TECHNOLOGY		
Teaching load distribution between lectures and independent student work	Non-contact classes: Face-to-face classes: Independent student work:		
Important information on data processing	Consult this link for more information.		
Language	Catalan: 30% Spanish: 70%		
Distribution of credits	Theory: 56.6% Practical lessons: 43.3%		

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
RAMOS GIRONA, ANTONIO JAVIER	antonio.ramos@udl.cat	3,9	
VIÑAS ALMENAR, M.INMACULADA C.	inmaculada.vinas@udl.cat	2,1	

Subject's extra information

The course aims to provide students with theoretical/practical knowledge necessary to understand the problems generated by the presence of microbial spoilage in food.

This compulsory subject is taught in the 2nd semester of 3rd year of the Bachelor Degree in Agricultural Engineering, in his specialty of Agricultural and Food Industries. Students must have previously studied the subject "Biology" (code 102510), where have acquired the basic concepts of General Microbiology required for this course, as general characteristics of prokaryotes, protists, fungi and viruses; microbiological media and their preparation; measurements of bacterial growth; chemical and physical methods of microbial control; environmental microbiology and microbiology of water.

The subject, could be complemented by "Food Analysis" (code 102580), an therefore graduates will be able to perform a complete analysis of a food.

Learning objectives

The objectives to be achieved in the course include:

RA1: Describe the origin and evolution of microorganisms in food.

RA2: Identify the effect that different conservation systems have on microorganisms in food.

RA3: Identify the main bacterial agents viral, fungal and food-related infections.

RA4: Knowing how to identify the main microbial spoilage of food.

RA5: Using microbiological analysis techniques of food

RA6: Propose suitable production processes and cleaning methods, as well as tools for hygienic production.

RA8: Solve problems and cases related to the subject.

R A9: Know the most common laboratory material, operate correctly and know the minimum safety standards to follow.

RA10: Properly prepare a lab report.

Competences

General skills

CG6. Capacity for the management of all kinds of food processing and/or rural industries, agricultural and livestock farms, urban green spaces, and public or private sports areas with knowledge of new technologies, processes, quality, traceability and certification and marketing techniques and marketing of food products and cultivated plants.

CG7. Knowledge in basic, scientific and technological materials that enable continuous learning and an ability to adapt to new situations or changing environments.

CG8. Ability to solve problems with creativity, initiative, methodology and critical thinking.

CG9. Leadership, communication and transmission of knowledge and skills in social policy areas.

CG10. Ability to search and use of the rules and regulations concerning its scope.

CG12. Ability to work in multidisciplinary and multicultural teams.

CG13. Correction in oral and written expression

CG15. Knowledge in information and communications technology

Specific skills

Ability to recognize, understand and use the principles of:

CEIAA1. Engineering and food technology. Engineering and basic food operations. Food Technology. Processes in the food processing industries. Modelling and optimization. Quality management and food safety. Food analysis. Traceability.

Subject contents

Course programme (33h)

Unit 1. (2 hour) Natural food contamination. Origin of microbial contamination of food and food products. Contamination during processing, storage, transportation and marketing. Microbiological control of the environment.

Unit 2. (4 hours) General principles of food spoilage. Intrinsic factors: Water activity (a_w), pH, redox potential, nutrients, antimicrobial substances, food structure and protective barriers. Extrinsic factors: temperature, humidity, gaseous atmosphere. Technological treatments. Implicit factors. Interaction of factors, synergisms and antagonisms.

Unit 3. (2 hour) General principles of food preservation. Application of bacterial growth curve to food preservation. The theory of combined methods. Principal methods of conservation. Asepsis. Maintenance under anaerobic conditions. Removal of microorganisms: washing, centrifugation, filtration.

Unit 4. (1.5 hours) Food preservation by radiation. Main characteristics of radiation of interest in food preservation: ionizing radiation and U.V. Factors influencing the lethal action. Microbial resistance and repair strategies. Influence on food quality. Legal status of the use of radiation.

Unit 5. (2 hours) Food preservation by drying. Desiccation effect on microorganisms. Pre-treatment and post-treatment of dry foods. Factors controlling desiccation. Main methods of drying. Intermediate moisture foods.

Unit 6. (2 hours) Food preservation by heat. Factors influencing the heat resistance of microorganisms. Thermodestruction concept. Survival plots the heat treatment temperature and time of death. Heat penetration. Effect of sublethal heat treatment.

Unit 7. (2 hours) Food preservation by cold. Influence of low temperatures on microorganisms. Key features of the psychrophilic and psychrotrophic microorganisms. Growth of microorganisms at low temperatures. Refrigeration. Effect of freeze/thaw on food. Microorganisms response to stress freezing/thawing.

Unit 8. (1 hour) Conservation by high pressures. Effect of high pressure on microorganisms. Mechanism of action. Advantages and disadvantages of treatment.

Unit 9. (1.5 hour) Chemical Food Preservation. Additives and preservatives: definitions and categories. The ideal preservative. Preservatives are added to food preservatives and originating in foods. Main organic and inorganic preservatives: type, structure, mechanism of action and properties. Curing and smoking. Gases and conservatives: modified atmospheres.

Unit 10. (2 hours) Water Microbiology. native and non-native microbiota. Types of water. microbiological parameters which determine water quality. Major pathogens: diseases and epidemiology. Purification and distribution of water for human consumption.

Unit 11. (2 hours) Microbiology of cereals, flours and derivatives. Initial contamination. Collection, transportation and storage of grains. Factors influencing the alteration of stored grains. Main pathogens and spoilage microorganisms. Molds and mycotoxins. major alterations. Main conservation methods.

Unit 12.- (2 hours) Microbiology of fruits, juices, vegetables and dairy products. Natural protection systems of fruit and vegetables. Initial microbiota. Post-harvest evolution. Juices. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 13.- (2 hours) Microbiology of meat and meat products. Initial microbiota. Obtaining hygienic meat. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 14. (1 hour) Microbiology of poultry meat. Initial microbiota. Influence of industrial processing stages on poultry meat microbial contamination. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 15.- (2 hours) Microbiology of eggs and egg products. Structure and composition of the egg: physico-chemical barriers. Routes of egg contamination. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 16.- (2 hours) Microbiology of milk and dairy products. Types of milk. Initial microbiota. Influence of industrial processing stages on milk microbial contamination. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 17.- (2 hours) Microbiology of fish and other foods from aquaculture. Peculiarities of fish, crustaceans and molluscs. Initial microbiota. Effect of initial treatment and storage on board. Importance of evisceration. Influence of ground handling. Main pathogens and spoilage microorganisms. Main alterations. Main conservation methods.

Unit 18.- (2 hours) Microbiology of canned foods. History of canning process. Canned and semi-canned food: definition and types. Classification of canned foods according to their acidity. Biological sterility and commercial sterility. Major pathogens and cause alterations in canned foods. Main alterations. Systematic examination of canned foods and microbiological analysis.

Practical lessons (25h)

At the Microbiology laboratory, sited at the building 2 of the ETSEA, lab. 3.01.

Practice 1.- Introduction to the Food Microbiology laboratory.

Practice 2.- Sampling and preparation of samples. Decimal dilutions.

Practice 3.- Microbiological recounts:

► Mesophilic aerobic microorganisms at 30 °C.

- ▶ Molds and yeasts.
 - ▶ Enterobacteria and kligler test.
 - ▶ E. coli β -glucuronidase positive
 - ▶ Staphylococcus coagulase positive.
 - ▶ Bacillus cereus
 - ▶ Clostridium perfringens
 - ▶ Enterococcus
- Practice 4.- Salmonella.
 Practice 5.- Listeria.
 Practice 6.- Fungal infection of grains.
 Practice 7.- Identification of filamentous molds.
 Practice 8.- Report of results.

It is MANDATORY that students have the following individual protection teams (EPI) in the course of teaching practices.

- White lab coat
- Safety glasses
- Gloves for chemical / biological protection

- Sanitary mask

The EPI can be purchased at UdL's ÚDELS store

Center for Cultures and Cross-Border Cooperation - Cappont Campus

Carrer de Jaume II, 67 low. 25001 Lleida.

Methodology

Due to the special circumstances derived from the health crisis caused by COVID-19, this subject will have both face-to-face classes and virtual teaching. In principle, exams, practices and some theoretical classes will be attended, which are specified in the "Development Plan" section of this Teaching Guide. In the event that the circumstances evolve towards a change in the attendance, it will be reported in due course.

Development plan

The detailed calendar and the Development Plan will be provided on the first day of the course, and will be published in the Resources section of the Virtual Campus, so that the student can organize in the most efficient way.

PLANNING FOOD MICROBIOLOGY GEAA

CURS 2020-2021

Week day	Day	Month	Hours	Accumulated hours	Lesson	Teacher
Monday	15	FEBRUARY	2	2	THEORY	A.J. Ramos
Wednesday	17	FEBRUARY	2	4	THEORY	A.J. Ramos
Monday	22	FEBRUARY	2	6	THEORY	A.J. Ramos
Wednesday	24	FEBRUARY	2	8	THEORY	I. Viñas
Monday	1	MARCH	2	10	THEORY	I. Viñas
Wednesday	3	MARCH	2	12	THEORY	I. Viñas
Monday	8	MARCH	2	14	THEORY	I. Viñas

Wednesday	10	MARCH	2	16	THEORY	I. Viñas
Monday	15	MARCH	2	18	THEORY	A.J. Ramos
Wednesday	17	MARCH	2	20	THEORY	A.J. Ramos
Monday	22	MARCH	2	22	THEORY	A.J. Ramos
Wednesday	24	MARCH	2	24	THEORY	A.J. Ramos
Wednesday	7	APRIL	2	26	THEORY	A.J. Ramos
Thursday	15	APRIL	Exam 11.10-14h, classroom 3.1.03.2			
Monday	19	APRIL	2	28	THEORY	A.J. Ramos
Wednesday	21	APRIL	2	30	THEORY	A.J. Ramos
Monday	26	APRIL	2	32	THEORY	A.J. Ramos
Wednesday	28	APRIL	2	34	THEORY	A.J. Ramos
Monday	3	MAY	--	--	--	--
Wednesday	5	MAY	1	35	THEORY	A.J. Ramos
Monday	10	MAY	--	--	--	--
Wednesday	12	MAY	--	--	--	--
Monday	17	MAY	--	--	--	--
Wednesday	19	MAY	--	--	--	--
Monday	24	MAY	5	5	PRACTICAL*	
Tuesday	25	MAY	5	10	PRACTICAL*	
Wednesday	26	MAY	5	15	PRACTICAL*	
Thursday	27	MAY	5	20	PRACTICAL*	
Friday	28	MAIG	5	25	PRACTICAL*	
Monday	31	MAIG	--	--	--	--
Wednesday	2	JUNE	--	--	--	--
Friday	18	JUNE	Exam 11.10-14h, classroom 3.1.03.2			
Wednesday	30	JUNE	Final Exam 11.10-14h, classroom 3.1.03.2			

* The week from 24 to 28 of May, will be a week of practical face-to-face lessons at the laboratory of Microbiology of building nº 2, 3rd floor, lab. 3.01., 25 hours long. Every day from 3:00 p.m. to 8:00 p.m. OBLIGATORY ASSISTANCE.

TIME COURSE

- Monday: de 10,10 a 12,00h.

- Wednesday: de 12,10 a 14,00h.

Classroom: 3.1.03.

Evaluation

Exams:

- First exam: will include the theory of the topics explained until the first evaluation period of the semester (tentatively from topics 1 to 10). Value: 40% of the subject.
- Second exam: will include the theory explained from what was examined in the first exam until the end of the subject (tentatively from topics 11 to 18) + questions from the practical part of the subject. Value: 45% of the subject (30 + 15%).

Each exam will have the following structure:

- Test with questions of true/false, in which every two bad will subtract a good (value: 70% of the value of the exam).
- 1 or 2 short questions (value: 30% of the exam value).

Practices:

- The practices are of compulsory attendance. The attention and attitude in the practical class is evaluated + preparation of a report of practices to be delivered as the deadline for the 2nd exam of theory of the subject. The report can be done in pairs. The non-presentation of the report or not doing it in time supposes the failure in the subject. Value of the practices (attitude + report): 15%.
- In the practice report, the exercises must be recorded, as well as the critical discussion of the results. To carry out this report, the criteria specified in the document "Check-list and rubric of the practice report" available in the "Resources" section of the Virtual Campus must be taken into account, where the value of each element that forms the memory. This document must be submitted signed by the authors together with the report.

Distribution of the evaluation:

Theory + practical exams: 85% (8.5 points). In any case, each exam must obtain a minimum score of 4.0 points (out of 10) so that the average of all assessment activities can be performed.

Practice report: 15% (1.5 points). The internship report is scored from 0 to +1.5 points.

For the purposes of the final grade, to pass the subject you must have obtained a grade equal to or higher than 4 out of 10 in the different evaluation activities, including the internship report. The average to pass the subject must be equal to or greater than 5 points.

Observations regarding the health crisis derived from COVID-19:

The evaluation will follow what is described above. In the event that due to restrictions caused by the health crisis, the planned face-to-face evaluations cannot be carried out, alternative evaluations will be carried out in a non-face-to-face way.

In the event that the practices cannot be carried out in person, they will be replaced by a report about methods of microbiological analysis of food, the weight of which in the evaluation of the subject will be equivalent.

Bibliography

Basic books

FRAZIER, W.C. y D.C. WESTHOFF. (1993). Microbiología de los alimentos. Acribia, Zaragoza.

I.C.M.S.F. (1983). Ecología microbiana de los alimentos. Vol I.: Factores que afectan a la supervivencia de los microorganismos en los alimentos. Acribia, Zaragoza

I.C.M.S.F. (2001). Microorganismos de los alimentos 6. Ecología microbiana de los productos alimentarios. Acribia, Zaragoza.

MADIGAN, M., MARTINKO, J. Y PARKER, J. (2003). Brock Biología de los Microorganismos. 10ª Edición. Ed. Prentice-Hall. Madrid.

MARKELL, E.K., VOGEL, M. y JOHN, D.T. (1990). Parasitología Médica. Editorial Interamericana×McGraw-

Hill.

PRESCOTT, L.M, HARLEY, J.P y KLEIN, D.A (2004). Microbiología. McGraw-Hill Interamericana, Madrid.

Complementary references

ACHA, P.N. y SZYFRES, B. (1989). Zoonosis y enfermedades transmisibles comunes al hombre y a los animales. Organización Panamericana de la Salud.

ALLAERT, C. y ESCOLÀ, M. (2002). Métodos de análisis microbiológicos de los alimentos. Díaz de Santos, Madrid.

JAY, J.M. (2002). Microbiología moderna de los alimentos. Acribia, Zaragoza.

MOSSEL, D.A.A., J.E.L. CORRY, C.B. STRUIJK *et al.* (1995). Essentials of the microbiology of foods. A textbook for advanced studies. John Wiley & Sons, Chichester.

MOSSEL, D.A.A. y B. MORENO. (1985). Microbiología de los alimentos: fundamentos ecológicos para garantizar y comprobar la inocuidad de los alimentos. Acribia, Zaragoza.