

COURSE SYLLABUS IN VEGETABLE FERMENTATION AND CANNING INDUSTRIES

Academic Year: 2020/2021

Identification and characteristics of the course				
Code	FSTD: 501262 EAFID: 502621		ECTS Credits	6
Course title (English)	Vegetable Fermentation and Canning Industries			
Course title (Spanish)	Industrias de Fermentación y Conservación de Vegetales			
Degree programs	Food Science and Technology (FSTD) Engineering in Agricultural and Food Industries (EAFID)			
Faculty/School	Agricultural Engineering School			
Semester	Second (6º)	Course type (compulsory/optional)	Compulsory	
Module	FSTD: Food technology EAFID: Specific Technology Agricultural and Food Industries			
Subject matter	FSTD: Food Industry EAFID: Food and Agriculture Industry			
Lecturer/s				
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Subject Area	Nutrition and Bromatology Food Technology			
Department	Animal Production and Food Science			
Coordinator (Only if there is more than one lecturer)	Francisco Pérez Nevado			

Competencies*
FOOD SCIENCE AND TECHNOLOGY COMPETENCIES 1. BASICS: CB1, CB2, CB3, CB4, CB5 2. GENERALS: CG3, CG4, CG8, 3. TRANSVERSALES: CT1, CT2

* The sections concerning competencies, course outline, teaching activities, teaching methodology, learning outcomes and assessment methods must conform to those included in the ANECA verified document of the degree program.

4. SPECIFICS: CECTA2, CECTA3, CECTA4, CECTA5, CECTA6, CECTA7

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES COMPETENCIES

1. BASICS: CB1, CB2, CB3, CB4, CB5
2. GENERALS: CG6, CG7, CG8, CG9, CG10, CG11, CG12,
3. TRANSVERSALES: CT1, CT2
4. SPECIFICS: CETE1

Contents

Course outline*

The main contents included in this subject are those related to the industrial production of canned and fermented vegetable products. Vegetable products of special importance in the region (tomato and fruits), as well as alcoholic beverages (wine, beer, cider, spirits), or pickles are included here. In addition, other food industries, such as vinegar or cocoa industries, are developed in this syllabus due to the relevant role of the microorganisms in their processes.

Course contents

SECTION I. OBTAINING AND IMPROVING MICROORGANISMS OF INDUSTRIAL INTEREST

Title of Unit 1. Obtaining microorganisms of industrial interest.

Contents Unit 1: Microorganisms of industrial interest and desirable characteristics. Isolation, Selection of microorganisms and Culture. Methods used in the concentration of cultures. Maintenance and conservation. Microbial metabolism applied to obtain products.

Title of the Unit 2. Improvement of the yield of the industrial fermentation processes.

Contents Unit 2. Justification for the breeding of micro-organisms used in food production. Classical methods of genetic manipulation. Recombinant DNA technology. Applications of Genetic Engineering in the food industry.

FOOD SCIENCE AND TECHNOLOGY

Competences:

Specific: CECTA2, CECTA4, CECTA6.

General: CG3, CG8.

Transversal: CT1.

Basic: CB1, CB2, CB3, CB5.

Learning outcomes: RA98, RA101, RA102.

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES

Competences:

Specific: CETE1

General: CG6, CG7, CG8, CG11

Transversal: CT1

Basic: CB1, CB2, CB3, CB5

Learning outcomes: RA138, RA141, RA142

SECTION II. INDUSTRIAL FERMENTATION PROCESSES

Title of the Unit 3. Characteristics of industrial fermentations. Fermentation systems.
Contents Unit 3: Types of Fermentations. Submerged cultures. Solid cultures. Design and preparation of culture media. Raw materials used for process control.

Title of Unit 4. Design and operation of industrial fermenters.
Contents Unit 4: Fermenters and Bioreactors. Types of Fermenters. Materials and components. Aeration and agitation systems. Control of physical, chemical and biological parameters. Maintenance of aseptic conditions. Scale-up. Final operations: recovery of industrial products.

FOOD SCIENCE AND TECHNOLOGY

Competences:

Specific: CECTA2, CECTA4, CECTA5, CECTA6.

General: CG3, CG8.

Transversal: CT1.

Basic: CB1, CB3, CB5.

Learning outcomes: RA98, RA101, RA102.

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES

Competences:

Specific: CETE1

General: CG6, CG7, CG8

Transversal: CT1

Basic: CB1, CB3, CB5

Learning outcomes: RA137, RA138, RA139, RA141, RA142

SECTION III. BEVERAGE PRODUCTION

Title of the Unit 5. The beer industry.

Contents Unit 5: The malting process. Obtaining sweet wort. Fermentation and final processes. Equipment used.

Denomination of the Unit 6. Production of white and sparkling wines.

Contents Unit 6: Microorganisms in winemaking. Process of elaboration of white wines. Sparkling wine elaboration process. Used equipment.

Title of the Unit 7. Production of red and rosé wines.

Contents Unit 7: The process of making red wines. The elaboration process of rosé wines. Other techniques used: continuous vinification, carbonic maceration, thermovinification. Used equipment.

Title of the Unit 8. Production of special wines.

Contents Unit 8: Liqueurous wines. Production and ageing of liqueur wines. Naturally sweet wines. Aromatized wines and other aromatized wine-based drinks. Used equipment.

Title of the Unit 9. Use of waste from the wine industry.

Content Unit 9: Waste from wine-making and its exploitation. Improvement of the process. Used equipment.

Title of the Unit 10. Production of cider and other fermented beverages.

Contents Unit 10: Cider making. Sake. Pulque. Others fermented beverages. Used

equipment.

Denomination of the Unit 11. Production of distilled alcoholic drinks.

Contents of Unit 11: Types of distilled beverages. Fermentation substrates. Production process. Used equipment.

FOOD SCIENCE AND TECHNOLOGY

Competences:

Specific: CECTA2, CECTA3, CECTA4, CECTA6, CECTA7.

General: CG3, CG4, CG8.

Transversal: CT1.

Basic: CB1, CB2, CB3, CB5.

Learning outcomes: RA97, RA98, RA99, RA100, RA101, RA102.

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES

Competences:

Specific: CETE1

General: CG6, CG7, CG8, CG10, CG11

Transversal: CT1

Basic: CB1, CB2, CB3, CB5

Learning outcomes: RA137, RA138, RA139, RA140, RA141, RA142

SECTION IV. PRODUCTION OF FERMENTED FOODS AND ADDITIVES

Title of Unit 12. Production of fermented table olives.

Contents Unit 12: Process of elaboration of green olives seasoned with Spanish style. Elaboration process of black olives without dressing and naturally matured. Used equipment.

Title of Unit 13. Elaboration of other types of pickles.

Contents Unit 13: Fermented cabbage. Gherkins. Other pickles: Almagro aubergines, spring onions and others. Used equipment.

Title of Unit 14. Production of vinegar.

Contents Unit 14: Vinegar production processes. Types of vinegar. Used equipment.

Title of Unit 15. Other fermented vegetable products.

Contents Unit 15: Foods Based on Fermented Soybeans: Soy Sauces and Pastes
Stimulant drinks: Cocoa, coffee, tea. Used equipment.

FOOD SCIENCE AND TECHNOLOGY

Competences:

Specific: CECTA2, CECTA3, CECTA4, CECTA6, CECTA7.

General: CG3, CG4, CG8.

Transversal: CT1.

Basic: CB1, CB2, CB3, CB5.

Learning outcomes: RA97, RA98, RA99, RA100, RA101, RA102.

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES

Competences:

Specific: CETE1

General: CG6, CG7, CG8, CG10, CG11

Transversal: CT1

Basic: CB1, CB2, CB3, CB5

Learning outcomes: RA137, RA138, RA139, RA140, RA141, RA142

SECTION V. CANNING INDUSTRIES.

Title of Unit 16. Processing of canned and semi-preserved fruits and vegetables.
 Contents of Unit 16: Definitions. Classification. Data of the sector. Processing. Effects on quality.

Title Unit 17. Industrial processing of tomato-derived products.
 Contents of Unit 17: Data of the sector. Definition. Composition. Processing

FOOD SCIENCE AND TECHNOLOGY

Competences:

Specific: CECTA2, CECTA5.

General: CG3, CG4

Transversal: CT1

Basic: CB1, CB3, CB5.

Learning outcomes assessed: RA96, RA98, RA99, RA101, RA102.

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES

Competences:

Specific: CETE1

General: CG6, CG7, CG8, CG10, CG11

Transversal: CT1

Basic: CB1, CB3, CB5

Learning outcomes: RA137, RA138, RA139, RA141, RA142

Contents of Laboratory-Pilot Plant (SL)

Practical Lesson 1. Laboratory-scale winemaking

Contents of the practical lesson: Carry out a wine fermentation in the laboratory using selected yeasts. Control the development of the fermentation. Know and use different techniques to carry out quality control of the final product.

Type and place: Pilot Plant (PP of vegetable products) and Laboratories (L71 and L75).

Material and instruments to be used: Plastic fermentation tanks, raw material (frozen grapes), crusher, filtration equipment, refractometer, optical microscopes.

FOOD SCIENCE AND TECHNOLOGY COMPETENCIES

Competences:

Specific: CECTA2, CECTA3, CECTA5, CECTA6.

General: CG3, CG4, CG8.

Basic: CB2, CB3, CB4, CB5.

Transversal: CT1.

Learning outcomes: RA97, RA98, RA99, RA100, RA101, RA102.

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES

Competences:

Specific: CETE1

General: CG7, CG8, CG9, CG10, CG11, CG12

Basic: CB2, CB3, CB4, CB5

Transversal: CT1

Learning outcomes: RA137, RA138, RA139, RA140, RA141, RA142

Denomination of Practical Lesson 2. Preparation of Spanish style table olives

Contents of the practical lesson: Perform a Spanish style table olive fermentation. Carry out quality control of the processing and the final product.

Type and place: Pilot Plant (PP of vegetable products) and Laboratories (L71 and L75).

Material and instruments to be used: Plastic fermentation tanks, raw material

(refrigerated olives), colorimeter, optical microscopes.

Competences:

FOOD SCIENCE AND TECHNOLOGY

Competences:

Specific: CECTA2, CECTA3, CECTA5, CECTA6.

General: CG3, CG4, CG8.

Basic: CB2, CB3, CB4, CB5.

Transversal: CT1.

Learning outcomes: RA97, RA98, RA99, RA100, RA101, RA102.

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES

Competences:

Specific: CETE1

General: CG7, CG8, CG9, CG10, CG11, CG12

Basic: CB2, CB3, CB4, CB5

Transversal: CT1

Learning outcomes: RA137, RA138, RA139, RA140, RA141, RA142

Name of Practical Lesson 3. Preparation of a tomato preserve

Contents of the practical lesson: Production of a tomato preserve in the pilot plant, from the previous preparation operations, to its packaging, thermal treatment and cooling. Control of the evolution of the internal temperature of the container. Calculation of the F0.

Type and place: Pilot plant (PP of vegetable products)

Material and instruments to be used: Blanching vat, thermocouple probe, laptop, ingredients and raw materials. Refractometer.

FOOD SCIENCE AND TECHNOLOGY

Competences:

Specific competences: CECTA2, CECTA5

General competencies: CG3, CG4

Transversal: CT1

Basic: CB2, CB3, CB4, CB5

Learning outcomes: RA97, RA98, RA99, RA100, RA101, RA102

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES

Competences:

Specific: CETE1

General: CG7, CG8, CG9, CG11, CG12

Transversal: CT1

Basic: CB2, CB3, CB4, CB5

Learning outcomes: RA137, RA138, RA139, RA140, RA141, RA142

Name of the Practical Lesson 4. Preparation of a fruit preserve

Contents of the practical lesson: Preparation of a fruit preserve in a pilot plant, from the previous preparation operations, to its packaging, thermal treatment and cooling. Control of the evolution of the internal temperature of the container. Calculation of the F0.

Type and place: Pilot plant (PP of vegetable products)

Material and instruments to be used: Blanching equipment, thermocouple probe, laptop, ingredients and raw materials. Refractometer.

Competencies:

FOOD SCIENCE AND TECHNOLOGY

Competences:

Specific competences: CECTA2, CECTA5

General competencies: CG3, CG4

Transversal: CT1

Basic: CB2, CB3, CB4, CB5

Learning outcomes: RA97, RA98, RA99, RA100, RA101, RA102

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES

Competences:

Specific: CETE1

General: CG7, CG8, CG9, CG11, CG12

Transversal: CT1

Basic: CB2, CB3, CB4, CB5

Learning outcomes: RA137, RA138, RA139, RA140, RA141, RA142

Educational activities *

Student workload (hours per lesson)		Lectures	Practical sessions				Monitoring activity	Homework
Lesson	Total	L	HI	LAB	COM	SEM	SGT	PS
1								
1	11	3					0,5	7,5
2	3	1,5						2
3	8	2					1,5	4,5
4	4	2						2
5	4,5	2						3
6	7	3						4
7	10,5	3					1,5	6
8	5	2						3
9	5	2						3
10	7,5	1,5					1,5	5
11	4,5	1,5						3
12	5,5	2						3,5
13	6,5	2						4,5
14	6	2						4,5
15	5	2						3
16	8	3					1	4
17	11	3						6
LABORATORIO/ PLANTA PILOTO								
1	10,5			7,5				3
2	12			7,5			1,5	3
3	7			4				3
4	6,5			3,5				3
Evaluación	2							2
TOTAL	150	37,5		22,5			7,5	82,5

GG: Grupo Grande (100 estudiantes).

PCH: prácticas clínicas hospitalarias (7 estudiantes)

LAB: prácticas laboratorio o campo (15 estudiantes)

ORD: prácticas sala ordenador o laboratorio de idiomas (30 estudiantes)

SEM: clases problemas o seminarios o casos prácticos (40 estudiantes).

TP: Tutorías Programadas (seguimiento docente, tipo tutorías ECTS).

EP: Estudio personal, trabajos individuales o en grupo, y lectura de bibliografía.

Teaching Methodology*

1. Lectures and discussion of theoretical content.
3. Laboratory, pilot plant and field practices.
4. Practical cases.
6. Development and presentation of seminars.
7. Use of the virtual classroom.
9. Study of the subject.
10. Search and management of scientific literature.
11. Exams

Learning outcomes *

FOOD SCIENCE AND TECHNOLOGY

RA97, RA98, RA99, RA100, RA101, RA102

ENGINEERING IN AGRICULTURAL AND FOOD INDUSTRIES

RA137, RA138, RA139, RA140, RA141, RA142

Assessment methods *

A) CONTINUOUS EVALUATION

1. Continuous evaluation (30%): activities of the in-person classes (theoretical and practical) and other online activities.
2. Final theory exam (60%): Degree of acquisition of theoretical knowledge and ability to relate and apply it.
3. Final practical exam (10%): Degree of acquisition of practical knowledge and ability to relate and apply it.

The student must be positively evaluated in each of the parts separately in order to pass the course. Attendance at practical lessons will be compulsory. A score of 5 out of 10 in the final theory and practice exams will be necessary in order to sum up the scores of the rest of the activities.

Assessment instruments used:

- Activities will be carried out in the classroom and laboratory related to the contents delivered in the theoretical and practical lessons.
- Questions and activities will be proposed in the Virtual Campus, in order to allow the application and expansion of the contents taught in theoretical lessons.
- A practical report will be made individually or in groups of up to 3 students.
- The final exam will consist of test-type questions, short questions, questions of development and of any other type, related to the delivered materia. Writing will be considered, not only knowledge, when evaluating the answers.

B) ALTERNATIVE SYSTEM WITH A GLOBAL EXAM

In order to be assessed by this alternative system, the student must fill in, sign, submit and register the corresponding application, which is available on the EIA website (Secretaría, trámites administrativos).

In the final exam, the student will have to pass a global test corresponding to the theoretical topics of the course, the seminars and the activities proposed throughout the course. In order to pass the course, it will be necessary to achieve a minimum of five points in each of the parts: theoretical contents (whose score will be 50% of the final mark), practical contents (whose score will be 25% of the final mark), as well as in the activities developed during the course (25% of the final mark). This test may be oral and/or written and will always have a practical part that will be developed in the laboratory and pilot plant to demonstrate the practical skills.

The announcements, grades and complaint periods for the exams will be displayed on the corresponding boards and through the virtual classroom of the subject in time and form as established by the regulations approved by the Governing Board and published by Resolución 9/03/2012, DOE nº 59 de 26 de marzo, modificadas por Resolución 27/11/2012, DOE nº 242, de 17 de diciembre y Resolución 17/03/2014, DOE 62, de 31 de marzo, y RESOLUCIÓN de 25 de noviembre de 2016, DOE nº 236 de 12 de Diciembre de 2016.

Bibliography (basic and complementary)

BIBLIOGRAFÍA BÁSICA

- ALEIXANDRE, J.L., GARCÍA, M.J. (1999). "Industrias agroalimentarias". Ed. Servicio de publicaciones de la Universidad Politécnica de Valencia. Valencia.
- ALEIXANDRE, J.L., GARCÍA (1999). "Prácticas de procesos de elaboración y conservación de alimentos". Ed. Servicio de publicaciones de la Universidad Politécnica de Valencia. Valencia.
- BOURGEOIS, C.M., LARPENT, J.P. (1995). "Microbiología alimentaria 2. Fermentaciones alimentarias". Ed. Acribia.
- BULLOCK, J., KRISTIANSEN, B. (1991). "Biotecnología básica". Ed. Acribia.
- CASP, A., ABRIL, J. (1999). "Procesos de conservación de alimentos". Ed. A. Madrid Vicente y Mundi-Prensa. Madrid.
- CRUEGER, W. CRUEGER, A. (1993). "Biotecnología: Manual de microbiología industrial". Ed. Acribia.
- HERNÁNDEZ PEÑARANDA, A. (2003). "Microbiología Industrial". Ed. EUNED.
- HOLDSWORTH, S. (1988). "Conservación de frutas y hortalizas". Ed. Acribia. Zaragoza.
- LEE, B.H. (2000). "Fundamentos de Biotecnología de los Alimentos". Ed. Acribia.
- LEVEAU J. Y., BOUIX M. (2000). "Microbiología industrial: los microorganismos de interés industrial". Ed. Acribia.
- SANCHEZ PINEDA DE LAS INFANTAS, M.T. (2003). "Procesos de elaboración de alimentos y bebidas". Ed. Mundi-Prensa Libros.
- SÁNCHEZ PINEDA DE LAS INFANTAS, M.T. (2005). "Procesos de conservación poscosecha de productos vegetales". Ed. Antonio Madrid Vicente.
- WALKER, J.M., GINGOLO, E.B. (1997). "Biología molecular y biotecnología". Ed. Acribia.
- WARD, O.P. (1991). "Biotecnología de la fermentación. Principios, procesos y productos". Ed. Acribia.

BIBLIOGRAFÍA COMPLEMENTARIA

- ALEIXANDRE, J.L. (2006). "La Cultura Del Vino: Cata Y Degustación". Ed. Servicio de publicaciones de la Universidad Politécnica de Valencia. Valencia.
- BLOUIN J., PEYNAUD E. (2003). "Enología práctica: conocimiento y elaboración del vino". Ed. Mundi-Prensa.
- FLANZY, C. (2003). "Enología: fundamentos científicos y tecnológicos". Ed. AMV Ediciones.
- GARCÍA GALLEGO, J. (2011). "Enología avanzada". Ed. Vértice.
- HIDALGO TOGORES, J. (2002). "Tratado de Enología (2 vols.)". Ed. Mundi-Prensa Libros.
- HOUGH, J.S. (1990). "Biotecnología de la cerveza y de la malta". Ed. Acribia, D.L.
- ICMSF. (1998). "Microorganismos de los alimentos 6. Ecología microbiana de los productos alimentarios". Ed. Acribia.
- MOLINA ÚBEDA, R. (2000). "Teoría de la clarificación de mostos y vinos y sus aplicaciones prácticas". Ed. Mundi Prensa.

- MORENO-ARRIBAS, M.V. (2011). "El vino". Ed. Consejo Superior De Investigaciones Científicas.
- MÜLLER, G. (1981) Microbiología de los alimentos vegetales. Ed. Acribia.
- PAINE, F., PAINE, H. (1994). "Manual De Envasado De Alimentos". Ed. A. Madrid Vicente Ediciones. Madrid.
- PEREDA RODRÍGUEZ, M.A. (2011). "Elaboración de sidra natural ecológica (Google eBook)". Ed. Mundi-Prensa Libros.
- ROSA, T. (1998). "Tecnología de los vinos blancos". Ed. Mundi-Prensa.
- RUIZ HERNÁNDEZ, M. (1991). "Vinificación en tinto". Ed. A. Madrid Vicente, D.L.
- SANCHIS, V. (2000). "La cerveza: Aspectos microbiológicos". Ed. Universidad, D.L.
- VALENZUELA ZAPATA, A.G. (2003). "El agave tequilero: cultivo e industria de México". Ed. Mundi-Prensa.
- VARNAM, A. H. (1996). "Bebidas: tecnología, química y microbiología". Ed. Acribia, D.L.
- VOGT, E. (1986). "El vino, obtención, elaboración y análisis". Ed. Acribia, D.L.
- VV.AA. (1985). "Biotecnología de la aceituna de mesa". Ed. Consejo Superior de Investigaciones Científicas.
- VV.AA. (1991). "El Vinagre de vino". Ed. Consejo Superior de Investigaciones Científicas.

Other resources and complementary materials

In general, the Campus Virtual will be used for the development of teaching the subject.

Prior to the lectures, the students will be provided with a summary that includes the main contents of the topic to discuss. This document will be uploaded to the Campus Virtual. In those cases where it is possible, case studies or relevant news that allow greater applicability of the topic will be analyzed, which will be sent as recommended readings in Moodle, some to deliver tasks and scoring and others only to support the teaching.

In addition, scientific articles related to each of the topics will be provided to contrast scientific studies with the contents seen in class.

Virtual resources:

For this, it is possible to use extension material, both bibliographic, and other documentation (ex: web pages) that allow developing other transversal or specific competences of the degree, ex: legal, scientific and technical advice to the food industry and consumers.

They will have all the information about practices, exam calls, grades...

Also, any congress related to the subject will be made available to the student, as well as interesting publications on topics related to the content seen in class.