



DEGREE CURRICULUM
**PLANT FOOD PROCESSING
TECHNOLOGY II**

Coordination: GRAELL SARLE, JORGE MARIANO

Academic year 2020-21

Subject's general information

Subject name	PLANT FOOD PROCESSING TECHNOLOGY II			
Code	102589			
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Agricultural and Food Engineering	3	COMPULSORY	Attendance-based
	Bachelor's Degree in Food Science and Technology	3	COMPULSORY	Attendance-based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRALAB	PRAULA	TEORIA
	Number of credits	1	0.6	4.4
	Number of groups	4	3	2
Coordination	GRAELL SARLE, JORGE MARIANO			
Department	FOOD TECHNOLOGY			
Teaching load distribution between lectures and independent student work	Classroom (attendance) hours: 60 Non-contact hours: 90			
Important information on data processing	Consult this link for more information.			
Language	CTA Group: Spanish / Catalan GEAA: Spanish			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GRAELL SARLE, JORGE MARIANO	jordi.graell@udl.cat	0	
IBARZ MARTÍNEZ, RAQUEL	raquel.ibarz@udl.cat	6,6	
ROMERO FABREGAT, MARIA PAZ	mariapaz.romero@udl.cat	6	
SALVIA TRUJILLO, LAURA	laura.salvia@udl.cat	2	

Subject's extra information

DEGREE IN FOOD SCIENCE AND TECHNOLOGY

Having overcome the fundamental subjects of the first and second year, third year in this course is intended to deepen the student's practical study of industrial processes of production of oils and fats in order to acquire the knowledge and skills of a technical expert in the field of oils and fats.

DEGREE IN AGRO-FOOD

Subject in the whole curriculum

The subject "Technology of processing plant foods I" belongs to the block of Food Industries.

Impart knowledge are aimed at the student learns to define complete manufacturing process of certain foods. The study of different industries include: a) sections of the industry and its operation, b) legislative, c) characteristics and composition of raw materials, d) diagram and operations processes, e) product characteristics , f) process control parameters and product quality g) management and use of waste and by-products. The industries included in this material are the fruits and vegetables (fresh), canned juices and vegetable sector.

Learning objectives

DEGREE IN FOOD SCIENCE AND TECHNOLOGY

The student to pass the course, must be able to:

- Assess the characteristics of different types of oil feedstocks that can be used in the processing industry of oils and fats.
- Specify the requirements to be met by oil raw materials for use in industrial processes of oils and fats.
- Select and plan the necessary steps to carry out a particular process of development of an oil or fat.
- Describe the action of the different technical parameters of an operation or industrial treatment on changes in the characteristics of oils and fats.
- Select the necessary equipment to be applied in each of the stages of a development process oils and fats.
- Solve the sizing of the required equipment capacity processing of oils and fats.
- Compare the different processes which can be applied for obtaining and / or processing of oils and fats, from a technological point of view and engineering.
- Specify the characteristics that, according to the relevant technical regulations submitted by different types and classes of commercial oils and fats.

- Interpret the analytical values of the characteristics of the products and by-products obtained during the development of an oil or fat to proceed with the regulation of the corresponding processes.
- Outline graphically sections that are part of an industry processing of oils and fats, to develop a preliminary design industry.
- Demonstrate knowledge of the nutritional virtues and the different possible uses of oils and fats in the food industry.

DEGREE IN AGRICULTURAL AND FOOD ENGINEERING

It is intended that the student will be able, in the context of different food industries studied in this field in:

1. Describe the food manufacturing processes.
2. Manage and know how to apply the various existing provisions affecting the food industries.
3. Outline, flowchart, process of preparing and preserving food.
4. Identify raw materials, ingredients, additives and other materials for use in the food industry.
5. Assess the influence of the composition and properties of the raw material quality.
6. Final product.
7. Interpret physical and chemical changes that occur within the various food manufacturing processes.
8. Changing processes based on objectives.
9. Organize production line manufacturing in food industry.
10. Associate composition and defects in the product with the raw materials and applied technology.
11. Select equipment for production lines and food packaging.
12. Sizing production lines and estimate the capabilities of processing equipment.
13. Having ability to develop new processes and food products .
14. Plan the management and use of products.

Competences

DEGREE IN FOOD SCIENCE AND TECHNOLOGY

General skills

CG2: That students know how to apply their knowledge to their work or vocation in a professional way and have the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study.

CG3: That students have the ability to gather and interpret relevant data to make judgments that include reflection on relevant issues of a social, scientific or ethical nature.

CG4: That students can convey information, ideas, problems and solutions to both specialized and non-specialized audiences.

CG6: Analyze specific situations, define problems, make decisions and implement action plans in the search for solutions.

CG7: Interpret studies, reports, data and analyze them numerically.

CG8: Select and release the available written and computerized sources of information related to the professional activity.

CG9: Use existing computer and communication tools as support for the development of their professional activity (UdL strategic competence)

CG10: Work alone and in a multidisciplinary team.

CG11: Understand and express themselves in the appropriate terminology.

CG12: Present information correctly orally and in writing (UdL strategic competence).

CG18: Have a critical and innovative spirit.

CG19: Analyze and assess the environmental implications in their professional activity.

Specific skills

Food technology

CE20: Evaluate the characteristics of the main vegetal varieties and his aptitude by the different processes of transformation.

CE22: Know the food processing equipment and know how to use it.

CE23: Outline, based on flow diagrams, the processes of food preparation and preservation.

CE24: Identify and evaluate raw materials, ingredients, additives and technological adjuvants for use in the agri-food industry.

CE26: Apply basic knowledge about raw materials, ingredients and additives to food formulation.

CE27: Interpret the physical and chemical changes that occur during the different food processing processes.

CE28: Modify the processes of making a food based on some objectives.

CE29: Select equipment and organize food processing and packaging lines.

CE30: Develop new processes and products.

CE31: Identify and value the various parts of a project in an agri-food industry.

CE32: Sizing production lines.

CE33: Estimate the capabilities of equipment for production lines and the needs of auxiliary systems.

DEGREE IN AGRICULTURAL AND FOOD ENGINEERING

General skills

CB1. That students have demonstrated knowledge and understanding in a field of study that is part of the basis of general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of your field of study.

CB2. That the students know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant issues of a social, scientific, or ethical nature.

CB4. That students can convey information, ideas, problems and solutions to both specialized and non-specialized audiences.

CB5. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

CG1. Capacity for the previous preparation, conception of projects that have by object the construction that by his nature and characteristics remain included in the agri-food industry.

CG6. Ability to direct and manage all kinds of agri-food industries, with knowledge of new technologies and quality processes.

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

CG10. Ability to research and use the rules and regulations relating to its scope of action.

CG12. Ability to work in multidisciplinary and multicultural teams.

CG13. Correction in oral and written expression

Specific skills

CEMC8. The management and use of agro-industrial by-products.

CEMC9. Decision making through the use of resources available for work in multidisciplinary groups.

CEIAA1. Food engineering and technology: Food technology. Processes in the agri-food industries.

Subject contents

DEGREE IN FOOD SCIENCE AND TECHNOLOGY

PART I - CEREAL TECHNOLOGY

Item 1 -. Baking.

Introduction - Definition and types of bread - Raw materials - Milling of cereals: Manufacture of flour - flour quality parameters - Graph and manufacturing stages. machinery and controls at each stage - aging phenomenon. bread - Application of cold: precooked frozen masses - Application of modified atmosphere packaging.

Item 2 -. Made biscuits.

Introduction - Definition and types of cookies - Raw materials: Features - Diagram and manufacturing stages. Purpose and machines at each stage.

Item 3 -. Manufacture of pasta.

Introduction - Definition and types of food pastes - Features quality pastes - Raw materials: Features - Diagram and manufacturing stages. Purpose machinery and controls at each stage.

PART II - OLIVE OIL TECHNOLOGY

Item 4 -. Olive oil. Composition and quality.

Composition of olive oil -. Classification of olive oils -. Quality of olive oils -. Considerations on the parameters of quality and purity of olive oils -. Diagrams processing of virgin olive oils.

Item 5 - The raw material. Olive. Previous operations process.

The olive. Structure and composition -. Olive ripening -. Variety -. Influence of climatic and agronomic factors -. Collection of olives -. Transportation of olives -. Reception of olives -. Cleaning and washing of olives -. Storage of olives -. Controls in olives.

Item 6 -. Operations about olive paste preparation.

Milling the fruit. Objectives - Types of mills. Comparison - Malaxation of olive paste.- Characteristics of malaxators - Features of olive paste - Difficult olives paste - Adding technological adjuvants.

Item 7 -. Operation of oil extraction. I. - Partial extraction system

Fundamentals of partial extraction -. Partial extraction equipment -. Factors influencing extraction -. Coadjuvants technology -. Handling process -. Advantages and disadvantages of partial extraction.

Item 8 -. Operation of oil extraction. II -. Pressing system.

Fundamentals of pressing system -. Description hydraulic press -. Operation pressing -. Factors affecting the operation -. Difficult paste. Technological Coadjuvants -. Advantages and disadvantages of the press system.

Item 9 -. Operation of oil extraction. III -. System of centrifugation.

Extraction of oil by centrifugation. Theoretical foundations - Description of decanter. Operation -. Factors affecting the operation -. Advantages and disadvantages of centrifuge system -. Centrifugation system of 2 phases -. Comparison between 2-phase centrifugation and 3-phase -. Technological coadjuvants.

Item 10 -. Operation of liquid phases separation.

Separation of liquids by decantation. Factors -. Facilities -. Separation of liquids by centrifugation. - Vertical centrifuges - Mixed system. Decantation and centrifugation.

Topic 11.- Management and process control.

Visual and analytical controls in products and byproducts. - Regulation of the press system - Regulation of centrifuge system 3 phase - Regulation of system 2-phase centrifugation - Process automation.

Item 12 -. Final operations. Storage and packaging of oils

Conservation of virgin olive oil: alterations - Properties of store deposits - Filtration of oils - Types of filters and application - Packaging oils - Terms and packaging types.

Item 13 -. Disposal and utilization of by-products of olive oil.

By-products: quantities and characteristics - Olive pomace. - Waste water. Environmental problems -. Disposal and utilization of waste water.

PART III: TECHNOLOGY OF SEED OILS.

Item 14 -. Preliminary operations.

Receiving seeds -. Storing seeds. Conditions -. Storage silos. Types -. Drying seeds. Types of dryers -. Cleaning and preparation of seed -. Crushing and laminate seeds -. Conditioning of seed.

Item 15 -. Removing oil per pressure.

Pressure oil extraction. Fundamentals - Continuous presses. - Advantages and disadvantages of the system pressure - Diagram of pressing system..

Item 16 -. Extraction by solvent oil.

Solvent extraction. Basics and benefits - Factors influencing solvent extraction - Extraction systems: percolation, immersion and mixed - Types of percolation extractors - Types of immersion extractors - Types of mixed extractors. - Special processes of solvent extraction.

Item 17 -. Final extraction operations.

Filtration of miscella -. Preconcentration miscella -. Distillation of miscella -. Desolventization of turtos -. Controls.

PART IV: TREATMENT OF OILS AND FATS

Item 18 -. Refining of oils and fats.

Objectives of the refining of oils and fats. - Degumming of oil. Equipment for neutralization of oils: chemical system - Bleaching of oils. Equipments -. Deodorization of oils.- Physical refining equipment, oils and fats -. Winterización of oils.

Item 19 -. Modification of oils and fats.

Hydrogenation of oils and fats. Fundamentals -. Applications in the food industry -. Hydrogenation equipment and facilities -. Problems of trans fatty acids -. Fat Interesterification - Margarine and "shortenings" - Other processes:. Obtaining biodiesel.

Practical activities

Seminars: will consist of some of the following activities:

- Interpretation of technical information from industrial equipment catalogs.
- Interpretation of information in scientific and technical articles.
- Analysis of technical regulations.
- Analysis of the contents of a draft of an industry.
- Exercises dimensioning calculations on an industrial process equipment.

Laboratory Practice: will consist of some of the following activities

- Extraction of olive oil for a centrifuge system (Abencor equipment).
- Analysis of parameters of quality and purity in oils.
- Sensory oil tasting.

DEGREE IN AGRICULTURAL AND FOOD ENGINEERING

CEREAL TECHNOLOGY

Item 1 Cereal storage

The grain and conditioning. Factors affecting grain quality. Treatments to stored grains. Grain drying and aeration.

Item 2 Dry Milling: wheat flour

Definitions and specifications of the mill products. Dry milling process: fundamentals. Cleaning and conditioning of the wheat. Grinding and classification. Storage and flour treatment.

Item 3 Corn Processing

Maize milling techniques: wet and dry roads. Products derived from the wet milling and dry. Milling process of corn wet. Cornstarch applications. Dry milling process of corn.

Item 4 Rice Processing

Products derived from processing rice. Process for obtaining white rice. Special Rice: parboiled and enriched.

Item 5 Technology malting

Processing of barley: Reception and quality control raw material. Storage. Grain cleaning and sorting. Malting: steeping, germination and drying. Degerminated and final cleaning. Composition and quality of malt.. Schematic of a malting.

Item 6 breadmaking process

Bread: definition and types. Diagram of the process. Mixing Operations: purpose, methods and equipment. Operations on mass: rest, division, and formed. Fermentation operation: principles, steps, factors and machinery. Controlled fermentation. Process and equipment. Cooking. Phenomena in the dough. Ovens. Conservation bread. Aging. Example baking industry.

Item 7 Process of making pasta

Definition and types of pasta. Specifications of raw materials for the production of pasta. Pulping process: Mixing and kneading, extrusion and cutting, drying. Equipment: Mixers, Extruders, Dryers. Parameters of quality pasta. Example pasta processing plant.

Item 8 Process of making cookies

Definition and types. Specifications flour cookie. Chemical agent.Process of making cookies: cookies, crackers and wafers. Example biscuit industry.

Item 9 Process of making breakfast cereals

Definition and types. Process of making flakes and puffed cereals. Enrichment of cereal.

Item 10 Beer

The brewing industry in Spain. Regulations of beer. Beer: definition and specifications. Permitted practices and prohibitions. Types of beer. Beer and health. General notions about the process of making beer.

Item 11 Brewing: Commodities

Carbohydrates. Quality criteria of malting barley. Attachments: raw grains and sugary compounds. Water. Water use in the malting and brewing industries. Effect of some ions. Corrections water. Hops. Description hops. Industrial classification. Composition of hops. Quality assessment of hops. Storing hops. Commercial presentations.

Item 12 Manufacture of beer wort

Introduction. The mashing. Crushing. Maceration. Filtering. Boil. Cooling. Composition and quality of the beer wort.

Topic 13 The fermentation

Fermentation objective. Preparation of wort for fermentation: aeration and seeding of microorganisms. Transformations during fermentation. Control of fermentation. Models of high, low and fast fermentations. Equipment for fermentation. Yeast recovery.

Item 14 Post-fermentation operations: the maturation of beer, final treatment and shipping.

Introduction. Second fermentation. Preventing turbidity. Cooling resistance. Artificial carbonation and standardization. Maturation of taste. Incorporation of additives. Models saved driving. Filtration: filter media in the brewing industry, filter selection for the beer industry. Pasteurization. Packaged.

OENOLOGY

Item 15 Wine

Definition of wine and other enological products according to the OIV. Wines. Wine composition. Nutritional quality of the wine. Outline the process of winemaking. Legal issues affecting winemaking.

Item 16 Harvest, shipping and receiving.

The wine grape: varieties. The bunch of grapes: composition. Study ripening of the grapes. Assessment of the quality of the grapes. Harvest. Transport of grapes to the winery. Facilities at the front desk controls. Control of raw materials. Discharge systems.

Topic 17 Technology juice extraction.

Introduction. Crushing and stemming. Pumping whole or crushed grape pulp. Maceration and drained. Pressing. Analysis of alternatives in the process of extraction of wort.

Topic 18 Conditioning musts.

The sulfur in winemaking. State of sulfur in musts and wines. The sulphite. Legal aspects of the use of sulfur. Substitute or complementary products. Clarification of musts. Effects of racking. Aids for racking: clarifiers and enzymes. Settling techniques: static and dynamic.

Topic 19 Technology fermentation of white wines.

Physical and chemical changes during fermentation. Importance of the fermentation temperature. Controlled fermentation. Interventions

during fermentation. Facilities for controlled fermentation.

Topic 20 Technology production of sparkling wine

Rules applicable to sparkling wines. Features of cuvées. Stages of development of natural sparkling: circulation, fermentation, disgorgement and shipping.

Item 21 fermentation technology red

Fermentation and maceration contemporary: Physical and chemical modifications. Control of maceration. Descube. Exhaustion of skins. Carbonic maceration. Thermovinification. Facilities traditional maceration. Current trends in equipment for maceration. The malolactic fermentation changes. Ideal conditions for malolactic fermentation. Use of bacterial cultures.

Topic 22 Maturation and aging of wines.

The role of oxygen in wine storage. Changes in aging. Aging in barrels. Bottle aging. Technical innovations and aging wine.

Item 24 Clarification. Filtration and centrifugation.

Introduction. The colloids in wine. The actions of the fining agents: mechanism and effects on clarifying wines. Fining: Inorganic and protein complexes. The practice of clarification. The filter media in oenology. Filtration techniques in the wine industry. Filtration land and precast beds. Sterile filtration membranes. Tangential filtration. Selection filtering technique. Spin wine.

Item 25 Stabilization

Stabilization:objective. Demetallating Treatments: Potassium ferrocyanide and phytates. Correction of acidity. Color Correction. Stabilization cooling: tartaric stabilization. Stabilization by heating: pasteurization. Adding stabilizer enological products with purpose.

OLIVE OIL

Item 26 Olive oil

Composition of olive oil - Classification of virgin olive oils - Quality olive oils - Considerations on the physicochemical and organoleptic parameters - Preparation of the olive oil: flowcharts - Typical sections in a industry

Topic 27 -. Preliminary operations.

The olive. Structure and composition -. Ripening fruit -. Variety -. Influence of climatic and agronomic factors. -. Collection and transportation of olives -. Reception of olives -. Cleaning and washing the olives -. Storing olives -. Controls -. Milling fruit. Types of mills -. Malaxation of the paste. Mixers -. Properties of paste -. Difficult paste. Addition of processing aids.

Topic 28 - Extraction of oil. Traditional systems.

Fundamentals of partial extraction -. Characteristics of partial extraction equipment -. Factors influencing extraction -. Processing aids -. Handling partial extraction process -. Advantages and disadvantages of partial extraction system -. Pressing system. Fundamentals -. Hydraulic press description -. Operation pressing -. Factors influencing pressing -. Difficult Paste. Processing aids -. Advantages and disadvantages of the press -. Controls and regulation of the press system.

Topic 29 - Extraction of oil. Continuous systems by centrifugation.

Theoretical Foundations of centrifugation -. Centrifugal description. Operation - Factors affecting the operation - Processing aids - Advantages and disadvantages of the centrifuge system - Controls and regulation centrifuge system - System 2-phase centrifugation. - Advantages and disadvantages of centrifugation 2 phase -. Controls and regulation of 2-phase system.

Topic 30 -. Separation of liquid phases and final operations.

Separation of liquid phase by decantation. Factors -. Facilities decantation -. Separation of liquid phase by centrifugation. - Vertical Centrifuges -. Mixed system -. Conservation oil. Alterations -. Properties of stores and deposits -. Filtration of oils. Types of filters and application -. Packaging oils. Conditions and types of packaging -. Labelling.

Topic 31 -. Disposal and utilization of by-products.

The byproducts of the manufacturing process of olive oil. Quantities and characteristics - The pomace. Exploitation -. 2-phase pomace. Exploitation -. The waste water. Environmental problems -. Disposal and utilization of waste water -. Wastes the process of making olive oil.

Practical activities

Practice 1: Brewing

The practice is the development of a beer, so that will be implemented knowledge related to various operations that are common with other processed products studied in this field:

- Physical control of malta

- Grinding grain
- Enzyme activity: modulation and control
- Fermentation. Seeding and control yeast fermentation
- Filtration

Practice 2: Extraction of olive oil in pilot plant

The extraction of virgin olive oil is made by the centrifugation, assessing the influence of various factors: type of olives, addition of adjuvants and temperature. Quality parameters in oils (degree of acidity, color, sensory attributes, ...) are valued.

Methodology

Bachelor's Degree in Food Science and Technology

Some face-to-face activities may happen to be carried out on-line due to the Covid pandemic.

Activity	Description	Face-to face Activity		Not face-to-face Activity		Evaluation		Total time /ECTS
		Objectives	Hours	Student work	Hours	Hours	Hours	
Master class in theory	Master class	Explanation of the main concepts	40	Study: Know, understand and synthesize knowledge	58	4		102/4
Problems i cases	Participatory class in the classroom	Problem solving and cases	8	Learn to solve problems and cases	8			16/0.7
Laboratory	Laboratory Practices	Execution of the practice in Laboratory	9	Make reports	8			17/0.7
Visites	Visit to companies	Attend the visit	2	Make reports	2			4/0.2
Totals			60		86	4		150/6

Observations: 25 hours of total activity per ECTS credit.

GRAU EN ENGINYERIA AGRÀRIA I ALIMENTÀRIA

Tipus d'activitat	Descripció	Activitat presencial alumne		Activitat no presencial alumne		Avaluació		Temps total/ECTS
		Objectius	Hores	Treball alumne	Hores	Hores	Hores	
Lliçó magistral	Classe magistral (Aula. Grup gran)	Explicació dels principals conceptes	38	Estudi: Conèixer, comprendre i sintetitzar coneixements	59	6		103h/4.12
Problemes i casos	Classe participativa (Aula. Grup gran)	Aplicació dels conceptes teòrics impartits a les classes magistrals	6	Resoldre problemes i casos	12			18h/0.72
Visites a indústries	Visita a dues empreses	Conèixer in situ els processos	6		4			10h/0.4
Laboratori	Pràctiques de laboratori (grup gran)		10	Redactar memòria	15			40h/1.6
Totals			60		82	8		150h/6 ECTS

Observations

25 hours of total activity per ECTS credit.

Evaluation

Bachelor's Degree in Food Science and Technology

Activity	Evaluation		Weight rating
	Procedure	Quantity	
Master class	Written tests on the theory of the subject program	2	80% (40+40)
Laboratory	Assistance and test on the practices carried out.		10%
Problem and cases (in classroom)	Solve exercises and test.		10%
Total			100

Observations:

- Attendance at all internship sessions is obligatory.
- For the purposes of the final grade, to pass the subject it will be necessary to have obtained at least a 4.5 in each of the written tests and an average of the same higher than 4.5 points.
- To pass the course it is necessary to obtain an overall grade equal to or higher than 5, considering all the activities evaluable with their weight (%).

- Note: If for health reasons, or other unforeseen circumstances, it is not possible to carry out face-to-face tests, these will take place remotely.

Bachelor's Degree in Agricultural and Food Engineering

	Avaluació		
Activity	Procedure	Quantity	Weight rating
Master class	Written tests on the theory of the subject program Short test at the end of each block	2 3	60 (30/30) 15
Test and cases	Evaluation of the reports delivered		10
Laboratory and Pilot Plant	Evaluation of the reports delivered Test about laboratory and pilot plant activities		5
Others	Assistance, participation in discussions and commitment to learning		5
Total			100

Observaciones

Attendance at all problem and case sessions, visits and internships is mandatory.

There will be two written theory tests and a written test to assess practices, problems and cases. For the purposes of the final grade, to pass the subject it will be necessary to have obtained at least a 4 in each of the written tests. To pass the course it is necessary to obtain an overall grade equal to or higher than 5, considering all the activities evaluable with their weight.

Bibliography

Bachelor's Degree in Food Science and Technology

The bibliography of technological subjects requires continuous review. However, some manuals are cited that despite having been written in some cases more than a decade ago, their content is suitable for a first contact with the study of processes in the food industries. At the beginning of the course, teachers provided a more complete list of bibliographic sources, including portals and Internet addresses with industry information.

Basic bibliography

- Bernardini, E., 1981. Tecnología de aceites y grasas. Ed. Alhambra. Madrid, 493 pp.
- Civantos, L., 1999. Obtención del aceite de oliva virgen (2ª ed.), Ed. Agrícola Española, S.A. Madrid, 279 pp.
- Gunstone, F.D., 2002. Vegetable oils in food technology. CRC Press, Boca Raton, USA.
- Hermoso, M., Uceda, M., García-Ortiz, A., Morales, J., Frías, L., Fernández, A., 1991. Elaboración de aceite de oliva de calidad. Colección: Apuntes, nº 5/91. Ed. Servicio de Publicaciones, Junta de Andalucía, Consejería de Agricultura y Pesca. Sevilla, 173 pp.
- Hermoso, M., González, J., Uceda, M., García-Ortiz, A., Morales, J., Frías, L., Fernández, A., 1995. Elaboración de aceite de oliva de calidad. II. Obtención por el sistema de dos fases. Apuntes 11/94. Servicio de Publicaciones, Junta de Andalucía, Consejería de Agricultura y Pesca. Sevilla, 95 pp.

Complementary bibliography

- Bockisch, M., 1998. Fats and Oils Handbook. AOCS Press, Champaign, USA.
- Kiritsakis, A.K., 1993. El aceite de oliva. Ed. AMV ediciones. Madrid.
- Carpio, A., Jiménez, B., 1993. Características organolépticas y análisis sensorial en el aceite de oliva. Colección: Apuntes 10/93. Ed. Servicio de Publicaciones, Consejería de Agricultura de la Junta de Andalucía. Sevilla, 74 pp.
- Frías, L., García-Ortiz, A., Hermoso, M., Jiménez, A., Llaveró, M^aPaz, Morales, J., Ruano, M^a.Teresa, Uceda, M., 1991. Analistas de laboratorio de almazara. Colección: Apuntes, nº6/1991. Servicio de Publicaciones, Consejería de Agricultura de la Junta de Andalucía. Sevilla, 107 pp.
- Hamm, W., Hamilton, R.J., 2000. Edible Oil Processing. CRC Press, Boca Raton, USA.

BACHELOR DEGREE IN AGRICULTURAL AND FOOD ENGINEERING

The bibliography of technological subjects requires continuous review. However, some manuals are cited that despite having been written in some cases more than a decade ago, their content is suitable for a first contact with the study of processes in the food industries. At the beginning of the course, teachers provided a more complete list of bibliographic sources, including portals and Internet addresses with industry information.

Basic bibliography

- AINIA Mejores técnicas disponibles en el sector cervecero. Ministerio de Medio ambiente (disponible en biblioteca, descargado pdf de Internet en campus virtual)
- HIDALGO, J. 2003 "Tratado de enología" Ed. MundiPrensa. Madrid. KUNZE, W. (2006) "Tecnología para cerveceros y malteros". VLB Berlin.
- CALAVERAS, J. (2004) "Nuevo Tratado de Panificación y Bollería" Ed. Mundi Prensa. Madrid.
- CALLEJO, M.J.; RODRÍGUEZ, G.; GIL, M (2001) Industrias de Cereales y Derivados. Ed. Mundi Prensa. Madrid
- CIVANTOS, L., 1999. Obtención del aceite de oliva virgen. Ed. Agrícola Española, S.A., Madrid.

Complementary bibliography

- BRIGGS, D.E.; HOUGH, J.S.; STEVENS, R and YOUNG, T.W. (1981) "Malting and brewing science. Vol. I Malt and sweet wort". 2ª ed. Chapman and Hall.
- E LINGER, H.M. (2009) "Handbook of Brewing" Ed Wiley-VCH

FLANZY, C. 2000 "Enología, fundamentos científicos y tecnológicos". Ed AMV. Madrid.

HOUGH, J.S.; BRIGGS, D.E.; STEVENS, R and YOUNG, T.W. (1982) "Malting and brewing science. Vol II Hopped wort and beer". 2ª ed. Chapman and Hall.

HERMOSO, M., UCEDA, M., GARCIA-ORTIZ, A., MORALES, J., FRÍAS, L., FERNÁNDEZ, A., 1991. Elaboración de aceite de oliva de calidad. Colección: Apuntes, nº 5/91. Ed. Servicio de Publicaciones, Junta de Andalucía, Consejería de Agricultura y Pesca. Sevilla.

HERMOSO, M, GONZÁLEZ, J, UCEDA, M, GARCÍA-ORTIZ, A, MORALES, J, FRÍAS, L, FERNÁNDEZ, A, 1995. Elaboración de aceite de oliva de calidad. II. Obtención por el sistema de dos fases. Apuntes 11/94. Servicio de Publicaciones, Junta de Andalucía, Consejería de Agricultura y Pesca. Sevilla.