



## IDENTIFYING DATA

### Wine science and technology

Subject	Wine science and technology			
Code	001G041V01911			
Study programme	Grado en Ciencia y Tecnología de los Alimentos			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language				
Department				
Coordinator	Centeno Domínguez, Juan Antonio			
Lecturers	Centeno Domínguez, Juan Antonio			
E-mail	jcenteno@uvigo.es			
Web				

**General description** The learning of the subject "Wine Science and Technology" aims to provide specific skills to the student to: Know the components of the bunch of grapes, their technological interest and their evolution throughout grape ripening; Describe the characteristics, properties and / or activities of microorganisms and enzymes involved in the winemaking process; Making and preserving wine; Controlling and optimizing vinifications; Know the equipment used in the winery; and Analyze and evaluate potential risks (mainly chemical risks), and manage safety in the oenological industry. The subject, of optional type, is related horizontally with five subjects taught in the first four-month period of the fourth year of the Degree, all of them entitled with the ending "...Science and Technology" (Milk, Meat, Fishery Products, Vegetable Products and Cereals).

## Training and Learning Results

Code	
A2	Students will be able to apply their knowledge and skills in their professional practice or vocation and they will show they have the required expertise through the construction and discussion of arguments and the resolution of problems within the relevant area of study.
B2	Students will acquire and put teamwork skills and abilities into practice, whether these have multidisciplinary character or not, in both national and international contexts, becoming familiar with a diversity of perspectives, schools of thought and practical procedures.
C2	To be familiar with the chemistry and biochemistry of food and of its associated technological processes.
C5	To be familiar with the basic operations in the food industry.
C6	To be familiar with the industrial processes linked with the processing and transformation of food.
C12	Ability to make and preserve food.
C13	Ability to analyze food.
C14	Ability to control and optimize processes and products.
D1	Analysis, organization and planning skills.
D4	Independent-learning and information-management skills.
D5	Problem-resolution and decision-making skills.

## Expected results from this subject

Expected results from this subject	Training and Learning Results
FROG1: To describe the components of the structures present in the bunch of grapes, indicating if applicable their properties of technological interest, and to explain their evolution throughout maturation	C2
FROG2: To describe the nature and properties of the enzymes, naturally present in the grape harvest or added during winemaking, responsible for alterations or desirable transformations in winemaking	C2 C6
FROG3: To know the main characteristics and the metabolic activities of the microorganisms, both desirable and harmful, involved in the vinification process	C2 C6

FROG4: To describe the composition and physical and physicochemical properties of the wine, and understand their relation to the sensorial or organoleptic characteristics	C2		
FROG5: To know the equipment and facilities of the winery and their operation, and acquire a basic criterion for their valuation and choice in the different situations	C5		
FROG6: To describe and understand the processes of vinification, their basis, the operations that integrate them, their particularities and the different modalities leading to the obtaining of different types of wine	C6		
FROG7: To know the different techniques of clarification, stabilization and conservation, as well as the different procedures for aging wines	C5		
FROG8: Ability to take representative samples from a vineyard and to follow the ripening process of the grapes	C13		
FROG9: Ability to work as a manufacturing or production technician in a wine cellar or wine industry	C14		
FROG10: Ability to regularize and improve productions, and to solve specific problems in vinifications	C12		
FROG11: Ability to diagnose and, where appropriate, treat the chemical and microbiological alterations of wine	C13		
FROG12: Ability to analyze and evaluate the food risks in a wine cellar or wine industry and to prepare a manual of hazards analysis and critical control points (HACCP)	C14		
FROG13: Ability to relate the oenological concepts, and to focus the challenges and problems in the winemaking field in an analytical and pragmatic way	A2	B2	D1
FROG14: Ability to document and discern information of interest with a view to solving specific problems in the winery or wine industry	A2		D5
FROG15: To adapt to new situations and problems		B2	D1
			D5

## Contents

Topic	
INTRODUCTION. THE WINE SECTOR	INTRODUCTION. BASIC CONCEPTS AND SOCIOECONOMIC ENVIRONMENT. Basic concepts. History of wine. Economic importance of the sector in Spain. The wine industry in Galicia: current situation and perspectives.
THE GRAPE AND THE GRAPE HARVEST	THE BUNCH OF GRAPES. Parts of the bunch. Quantitative proportions. Stem composition. Grain structure and components. Composition of ripe grapes. Properties of the phenolic compounds present in the bunch.  RIPENING OF THE GRAPE. Stages in grape growth. Modifications during the ripening process. Changes in grain size. Evolution of sugars. Evolution of minerals. Evolution of organic acids. Evolution of nitrogenous substances. Evolution of polyphenols and aromas. Evolution of vitamins. Monitoring ripening: ripening indexes.  THE GRAPE HARVEST. Fixing the harvest date. Transport of the grape harvest: undesirable phenomena of fermentation, oxidation and maceration. Quality of vintages. Corrections in the grape harvest, in the must and in the wine.  PREFERMENTATIVE TRANSFORMATIONS OF THE GRAPE HARVEST. Types of prefermentative modifications. Polyphenoloxidase enzymes: classification and actions. Influence of vinification conditions on the activity of oxidoreductases. Pectolytic enzymes of the grape: types and actions. Oenological applications of exogenous pectolytic enzymes and aroma enhancing enzymes.
MICROBIOLOGICAL AND BIOCHEMICAL ASPECTS OF VINIFICATION	MICROBIOLOGICAL ASPECTS OF VINIFICATION. Natural microbiota of the grape harvest. Yeasts. Lactic acid bacteria. Acetic bacteria.  BIOCHEMICAL ASPECTS OF VINIFICATION. Yeast metabolism: alcoholic fermentation and glyceropyruvic fermentation. Metabolism of lactic acid bacteria: malolactic fermentation. Metabolism of acetic bacteria: acescence or acetic souring.

## VINIFICATION EQUIPMENT AND FACILITIES

VINIFICATION EQUIPMENT AND FACILITIES. I. The winery and its equipment: criteria of design and location. Equipment for reception and preliminary handling of the grape harvest. Mechanical treatments of the grape harvest: operations prior to fermentation. Destemming. Squeezing. Must draining.

VINIFICATION EQUIPMENT AND FACILITIES. II. Pressing: classification, description and operation of presses. Vatting: materials, characteristics and types of vats or tanks. Systems for the removal and storage of grape marcs.

---

## TECHNOLOGICAL ASPECTS OF VINIFICATION

COMMON OPERATIONS IN DIFFERENT VINIFICATIONS. Use of sulfur dioxide: properties, forms of presentation, procedures and doses of use. Addition of yeasts: preparation of a vat foot and use of active dry yeasts. Control and monitoring of alcoholic fermentation. Fermentation arrest: causes and interventions.

THE VINIFICATION OF WHITE WINES. General characteristics of the vinification of white wines. Vinification of dry white wine: must extraction. Must treatments: demudding, bentonite treatment and protection against oxidation. Alcoholic fermentation: control of fermentation. Racking and final operations. Vinification with prefermentative maceration.

THE VINIFICATION OF ROSÉ WINES. Characteristics of rosé wines. Manufacture as white wine or by direct pressing. Vinification with short or partial maceration. Other methods of vinification: manufacture as (semi-)red wine, vinification with dipping of bunches.

THE VINIFICATION OF RED WINES. General characteristics of the vinification of red wines. Vatting operation: devices. Management of fermentation-maceration operation. Factors involved in the extraction of grape compounds during vatting. Duration of the vatting operation. Devatting. Pressing. Malolactic fermentation. Final operations.

VINIFICATION WITH CARBONIC MACERATION. Processes during carbonic maceration. Intracellular fermentation of the grape: metabolism of malic acid. Dissolution of components of the solid parts. Operations: reception and vatting of the grape harvest. Development and control of carbonic maceration. Devatting, pressing and alcoholic fermentation. Characteristics of wines made by carbonic maceration.

SPECIAL VINIFICATIONS: LIQUOR WINES, SWEET WINES AND SPARKLING WINES. Liquor wines. Sweet wines made with overripe grapes. Elaboration of toasted wines. "Generous" (high alcoholic strength) wines. Manufacture of Jerez wines. Sparkling wines. Classification. Manufacture by the champagne method.

---

## CLARIFICATION AND STABILIZATION TREATMENTS

CLARIFICATION TREATMENTS: GLUING AND FILTRATION. Spontaneous clarification and racking. Clarifying by gluing: protein, industrial synthesis and mineral clarifiers. Clarification by filtration: alluvial filters, plate filters, membrane filters. Amyrobic or sterilizing filtration.

TREATMENTS FOR THE STABILIZATION OF WINES. Cold treatments: tartaric stabilization by cold maintenance, by contact, and continuous treatment. Stabilization chemical techniques: use of metatartaric acid, mannoproteins, carboxymethylcellulose and gum arabic.

---

## CONSERVATION, AGING AND BOTTLING OF WINES

TREATMENTS FOR THE CONSERVATION OF WINES. Use of preservatives and antioxidants: sorbic acid, ascorbic acid, lysozyme. Applications of gases in the wine industry.

AGING OF WINES. Requirements of grape harvest and wines for aging in wooden barrels. Technology of oxidative aging and bottle aging. Accelerated aging: methods.

BOTTLING OF WINES. Washing, conditioning and filling of bottles. Complementary operations: capping and encapsulation. The cap: structure and properties of cork and synthetic materials.

---

## LABORATORY PRACTISES

ANALYSIS OF GRAPE JUICE OR MUST. Determination of acidity, Brix degrees and pH. Calculation of a ripening index. Calculation of potential alcoholic degree.

WINE MICROBIOLOGY. FOLLOW-UP OF ALCOHOLIC FERMENTATION AND MALOLACTIC FERMENTATION. Microscopic observation of microorganisms. Preparation of microbial cultures. Density and temperature determinations in fermenting must. Determination of reducing sugars in wine. Determination of malic acid in wine.

STABILITY, LIMPIDITY AND COLOR OF WINES. Resistance tests against precipitations of chemical origin. Gluing tests. Determination of the color of red wines.

STARTING A MINI-VINIFICATION OF A WHITE WINE. Addition of sulfur dioxide to grape harvest and must. Addition of pectolytic enzymes. Squeezing and presseing. Static demudding. Addition of yeasts. Bentonite treatment of fermenting must. Alcoholic fermentation.

STARTING A MINI-VINIFICATION OF A RED WINE. Destemming, squeezing and vatting. Addition of sulfur dioxide to grape harvest. Addition of yeasts. Alcoholic fermentation and maceration.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	28	42	70
Laboratory practical	14	7	21
Seminars	14	7	21
Studies excursion	0	8	8
Mentored work	0	20	20
Autonomous problem solving	0	10	10

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description
Lecturing	Theoretical activity. Explanation by the professor of the contents on the subject, and the theoretical bases and / or guidelines of the works and exercises to be developed by the students
Laboratory practical	Guided practical activity. Acquisition activities of basic and procedural skills related to the subject (analytical determinations, manufacture of small-scale products, quality control tests, etc.). They will take place in the laboratory of Food Technology practices
Seminars	Guided practical activity. Activities focused on the work on a specific topic, which allow to complement or deepen the contents of the subject. They will be used as a complement to the theoretical classes
Studies excursion	Guided practical activity. Activities of application of knowledge to concrete situations. If possible, a visit will be made to a small and a large dairy industry
Mentored work	Autonomous practical activity. Preparation and presentation by students, before the professor and classmates, of a bibliographic review document on a current topic related to the subject. It is an autonomous student activity focused on the search, collection and processing of information, including the reading and management of specialized bibliography (databases, scientific journals). It will be carried out in groups (groups of three / four students), and the works will be presented in hours for seminars (1 hour per group)
Autonomous problem solving	Autonomous practical activity. Tasks in which exercises related to the subject are formulated as multiple-choice tests. The student must perform the exercises individually. The tests corresponding to each subject or module in which the subject is structured will be presented through the TEMA on-line teaching platform

Personalized assistance	
Methodologies	Description
Mentored work	Specific documentation will be provided. Students will be advised on information search and bibliographic review. The preparation and exposition of the works will be supervised, making the appropriate corrections and suggestions. Personalized attention may take place by telematic means under prior agreement
Autonomous problem solving	Clarification of the doubts raised in the resolution of the questionnaires. Personalized attention may take place by telematic means under prior agreement

Assessment				
	Description	Qualification	Training and Learning Results	
Lecturing	The knowledge acquired through this teaching methodology will be evaluated by means of an exam of short answer essay questions (final exam)	40	C2 C5 C6 C12 C13 C14	
Laboratory practical	The knowledge acquired through this teaching methodology will be evaluated by means of an exam of short answer essay questions (final exam)	10	C6 C12 C13 C14	
Seminars	The knowledge acquired through this teaching methodology will be evaluated by means of an exam of short answer essay questions (final exam)	10	C2 C5 C6 C12 C14	D1
Mentored work	The preparation and presentation of the work (within a group)	20	A2 B2	D1 D4 D5
Autonomous problem solving	The resolution of the proposed exercises (multiple-choice tests) will be evaluated through the on-line teaching platform	20	A2	D4 D5

### Other comments on the Evaluation

The preferred evaluation modality is **Continuous Evaluation**. The student who chooses the **Global Evaluation** (100% of the grade obtained in the official exam) must notify the teacher responsible for the subject, either by email or through the Moovi tele-teaching portal, within a period not exceeding one month from the beginning of the teaching of the subject. In the **Continuous Evaluation** modality, the final exam will be considered (to be added to the rest of the scores) provided that a minimum mark of 4 out of 10 is obtained. In the second edition or second evaluation opportunity, the possibility is considered that those students who request it previously may be evaluated with a single exam of the entire subject, which will represent 100% of the qualification.

**Final exam call:** the student who chooses to be tested at the end of the course call will be evaluated only by the exam (which will represent 100% of the qualification). In case of not attending this examination, or not passing it, he will be evaluated in the same way as the rest of the students.

**Dates of exams:** end of the course, 09/22/2023 at 16:00 h; first edition, 11/08/2023 at 16:00 h; second edition, 07/08/2024 at 16:00 h. In case of error in the transcription of the examination dates, the valid ones will be the ones officially approved and published in the bulletin board and in the web site of the Center.

Grading system: will be expressed by a numerical final qualification of 0 to 10 according to the current legislation (Spanish Royal Decree 1125/2003 of September 5, B.O.E. of September 18).

### Sources of information

#### Basic Bibliography

HIDALGO, J., **Tratado de enología, vols. 1 y 2**, 9788484767527, 3ª, Mundi-Prensa Libros, S.A., 2018

ALEIXANDRE, J.L.; ÁLVAREZ, I., **Tecnología enológica**, 9788497561266, 1ª, Síntesis, S.A., 2003

BLOUIN, J.; PEYNAUD, E., **Enología práctica: conocimiento y elaboración del vino**, 9788484761600, 4ª, Mundi-Prensa Libros, S.A., 2003

#### Complementary Bibliography

DE VITA, P.; DE VITA, G., **La distillazione enologica: Manuale per la produzione di alcol etilico, grappa, brandy e la valorizzazione dei sottoprodotti vitivinicoli**, 9788836008766, 1ª, Hoepli, 2022

MADRID, A., **Equipamiento vinícola. Equipos e instalaciones en las modernas bodegas**, 9788412239430, 1ª, AMV Ediciones, 2020

MADRID, A., **Elaboración de vinos espumosos y cavas**, 9788412152302, 1ª, AMV Ediciones, 2020

BORDIGA, M., **Post-fermentation and -distillation technology: stabiliization, aging, and spoilage**, 9781498778695, 1ª, CRC Press. Taylor & Francis Group, 2018

MORENO VIGARA, J.J.; PEINADO AMORES, R.A., **Química enológica**, 9788484763901, 1ª, Mundi-Prensa Libros, S.A., 2010

JACKSON, R.S., **Análisis sensorial de vinos. Manual para profesionales**, 9788420011271, 1ª, Acribia, S.A., 2009

RIBÉREAU-GAYON, P.; DUBOURDIEU, D.; DONECHE, B.; LONVAUD, A.; GLORIES, Y.; MAUGEAN, A., **Tratado de enología, vols. 1 y 2**, 9789505045716, 2ª, Hemisferio Sur - Mundi-Prensa Libros, S.A., 2008

LIBERATI, D., **Los tapones sintéticos en enología**, 9788484762935, 1ª, Mundi-Prensa Libros, S.A., 2008

GRAINGER, K.; TATTERSALL, H., **Producción de vino: desde la vid hasta la botella**, 9788420010847, 1ª, Acribia, S.A., 2007

CARRASCOSA, V.; MUÑOZ, R.; GONZÁLEZ, R., **Microbiología del vino**, 9788487440069, 1ª, AMV Ediciones, 2005

GIRARD, G., **Bases científicas y tecnológicas de la enología**, 9788420010267, 1ª, Acribia, S.A., 2004

ZAMORA, F., **Elaboración y crianza del vino tinto: aspectos científicos y prácticos**, 9788489922884, 1ª, AMV Ediciones, 2004

FLANZY, C., **Enología: fundamentos científicos y tecnológicos**, 9788484760740, 2ª, AMV Ediciones - Mundi-Prensa Libros, S.A., 2003

RANKINE, B., **Manual práctico de enología**, 9788420008936, 1ª, Acribia, S.A., 1999

DE ROSA, T., **Tecnología de los vinos blancos**, 9788471147004, 1ª, Mundi-Prensa Libros, S.A., 1998

OUGH, C.S., **Tratado básico de enología**, 9788420008066, 1ª, Acribia, S.A., 1996

**Alimentación, Equipos y Tecnología. Madrid: Alción. ISSN: 0212-1689,**

**Alimentaria: Revista e Tecnología e Higiene de los Alimentos. Madrid. ISSN: 0300-5755,**

**La Semana vitivinícola: revista técnica de interés permanente. Valencia: Salvador Estela Alfonso,**

**Viticultura Enología Profesional. Barcelona: Agro Latino. ISSN: 1131-5679,**

**American journal of enology and viticulture. Davis, Calif. [etc.]: American Society of Enologists,**

**Journal International des Sciences de la Vigne et du Vin. Bordeaux: Vigne et Vin Publications Internationales. ISSN: 1151-0825,**

**Practical Winery & Vineyard. San Rafael, California: D. Neel. ISSN: 1057-2694,**

**Revue des oenologues et des techniques vitivinicoles et oenologiques. Macon: Union Française des Oenologues,**

**Revue française d'oenologie. Paris: Union Nationale des Oenologues,**

**Vitis: Journal of Grapevine Research. Siebeldingen: Bundesforschungsanstalt für Rebenzüchtung Gellweilerhof. ISSN: 0042-7500,**

[http://www.perseo.biblioteca.uvigo.es/search\\*sp](http://www.perseo.biblioteca.uvigo.es/search*sp),

<http://www.scopus.com>,

<http://bddoc.csic.es>,

<http://www.westlaw.es/wles/app/login/subscription>,

<http://sfx.bugalia.org/vig/az?lang>,

<http://www.alimentatec.com>,

<https://www.enoforum.eu/es>,

<https://www.vinetur.com/noticias>,

<https://catavinos.wordpress.com>,

<https://www.agriaffaires.es>,

<http://www.icv.fr>,

<http://www.fev.es/es>,

<https://www.oemv.es>,

[gienol@listserv.rediris.es](mailto:gienol@listserv.rediris.es),

## Recommendations

### Subjects that are recommended to be taken simultaneously

Analysis and quality control in enology/O01G041V01912

### Subjects that it is recommended to have taken before

Food chemistry and biochemistry/O01G041V01404