



## IDENTIFYING DATA

### Biotechnological processes and products

Subject	Biotechnological processes and products			
Code	V12G350V01922			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Longo González, María Asunción			
Lecturers	Longo González, María Asunción			
E-mail	mlongo@uvigo.es			
Web	<a href="http://moovi.uvigo.gal/">http://moovi.uvigo.gal/</a>			

**General description** The use of microorganisms for the transformation of raw materials has been carried out by humans since antiquity, although it is more recent (2nd half of 20th century) the use of biocatalysts (microorganisms, enzymes or other biological systems) in industrial processes. The biotechnology industry can be considered an emerging sector of high economic profitability, which makes it necessary to have the scientific and technological knowledge that allow developing and adapting bioprocesses in the different sectors of application.

The subject aims to provide students with a global view on the use of biocatalysts (microorganisms, cells or biomolecules) for the development of biotechnological industrial processes as an alternative to traditional processes. The main unit operations involved in this type of process will be studied, as well as the specific aspects that differentiate them from conventional industrial chemical processes. Given that it is a field in continuous expansion, reference will be made to the most recent advances and trends.

English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.

## Training and Learning Results

Code	
B3	CG3 Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
C16	CE16 Basic knowledge and application of environmental technologies and sustainability.
C19	E19 Knowledge of mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and recovery and processing of raw materials and energy resources.
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D3	CT3 Oral and written proficiency.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D16	CT16 Critical thinking.
D17	CT17 Working as a team.

## Expected results from this subject

Expected results from this subject	Training and Learning Results
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Identification of the basic concepts of biotechnological processes, their products and their sources.	B3 B4	C19	D1 D2 D3 D9 D10
Knowledge and understanding of the biotechnological processes carried out by microorganisms of industrial interest, the stages of transformation and separation of products and the most common equipment used.	B3 B4	C16 C19	D1 D2 D3 D9 D10 D16 D17
Being able to propose biotechnological processes in different areas, through knowledge of methodology, requirements and regulations, considering aspects related to the environment, energy and resources.	B3 B4	C16 C19	D1 D2 D3 D9 D10 D16 D17

## Contents

Topic	
Fundamentals of biotechnological processes: microorganisms, enzymes and other metabolites of industrial interest.	- Introduction to biotechnological processes. Microbiological and biochemical fundamentals, and raw materials used.
Technology of biotechnological processes and products. Design of a biotechnological process. Practical cases.	- Preparation of raw materials. - Reaction stage. Kinetics and operation of bioreactors. - Recovery and purification operations. - Study of commercial biotechnological processes and new trends.
Process intensification, energy integration, environmental and biosafety considerations.	- Energy integration methodologies - Introduction to the assessment of environmental impact of processes. - Biosafety. Best available techniques in the biotechnology industry.

## Planning

	Class hours	Hours outside the classroom	Total hours
Case studies	9.5	24.5	34
Laboratory practical	18	18	36
Presentation	2	12	14
Lecturing	15	15	30
Mentored work	3	17	20
Seminars	3	11	14
Essay questions exam	1	0	1
Problem and/or exercise solving	1	0	1

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

## Methodologies

	Description
Case studies	Processes of interest will be selected, which are representative of the current trends in the biotechnology sector, and a critical analysis will be carried out, in groups or individually. Short presentations will be made in the classroom, encouraging debate, as much as possible.
Laboratory practical	Laboratory experiments and field practices in companies related to the processes treated throughout the course will be carried out. The students will have the support material necessary for a proper understanding of the experiments to be carried out. A brief final report will be prepared in which the main results and conclusions should be collected.
Presentation	The students will make brief presentations of the cases studied in the classroom, as well as the supervised work. A question time will be included, in which the questions posed must be answered.

Lecturing	The lecturer will present the general aspects of the program in a structured way, with special emphasis on the fundamentals and most important or difficult to understand aspects. The lecturer will provide, through the Tem@ platform, the necessary material for a correct follow-up of the subject. The student will be able to work previously the material handed out by the lecturer and consult the recommended bibliography to complete the information.
Mentored work	The students will develop a small project on a subject assigned by the lecturer. The work will be carried out in groups, that will deliver a written essay and make a presentation.
Seminars	Proposal and resolution of practical cases related to the subject matter. Complementary activity to the case study.

### Personalized assistance

Methodologies	Description
Lecturing	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).
Laboratory practical	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).
Seminars	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).
Mentored work	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).
Case studies	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).
Presentation	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).

### Assessment

	Description	Qualification	Training and Learning Results
Case studies	The work done during the seminars, case studies and practical classes will be evaluated based on: - assistance - attitude and participation of the students during the sessions - quality of submitted reports	20	B3 C16 D1 B4 C19 D2 D3 D9 D10 D16 D17
Presentation	The students will make a presentation of the supervised work, which will be assessed based on its clarity, rigor and demonstration of the knowledge acquired on the subject.	10	D1 D3 D16 D17
Mentored work	The report presented on the assigned work subject will be evaluated. This report must include some minimum aspects, based on a guide that will be provided to the students.	10	B3 C16 D1 B4 C19 D2 D3 D9 D10 D16 D17
Essay questions exam	Written tests will be carried out, which will include essay questions, for the evaluation of the acquired competences in relation to the contents of the course.	30	B3 C16 D1 B4 C19 D2 D3 D9
Problem and/or exercise solving	Written tests will be carried out, which will include short questions or exercises and problems, for the evaluation of the acquired competences in relation to the contents of the course.	30	B3 C16 D1 B4 C19 D2 D3 D9

### Other comments on the Evaluation

#### 1. Considerations on continuous evaluation.

- The participation of the student in any of the acts of evaluation of the course will imply the condition of presented and, therefore, the assignment of a qualification.
- Attendance at a minimum of 80% of practical classes (laboratory, industry visits, seminars) is mandatory, which cannot be recovered.
- To pass the course, students must obtain at least a score of 5 points out of 10 in the partial exam and in the final exam, and a minimum of 4 points out of 10 in each of the other evaluation sections (practical classes, project). In any case, the overall qualification required to pass the course, resulting from the weighted sum of all the evaluation sections, will be 5 points out of 10.
- Students may waive the continuous assessment system through the procedure and within the period established by the School. If such resignation is requested and authorized, 100% of the grade will be assigned by taking a final exam, in which questions can be asked about all the topics taught in the course, including those corresponding to practical classes.

## 2. Considerations about the exams (partial and final).

- **Partial exam.** During the course there will be a partial and eliminatory test, which will include problems and/or exercises, as well as essay questions, and which will have a weight in the overall grade of 30 %. To pass this test, a score of at least 5 points out of 10 must be obtained.
- **Final exam 1st opportunity.** It will include the contents not evaluated in the partial test, and will have a relative weight of 30 % in the overall grade of the course. In case of not having passed the partial test, the students will be given the opportunity to repeat the evaluation of the corresponding contents, on the same date assigned for the final exam.
- **Final exam 2nd opportunity.** The exam may put forward questions about all the subjects taught in the course, including those corresponding to practical classes. Students who have obtained the minimum qualification established in this guide for the various evaluation sections (practical classes, project, partial exam), may only be assessed for the rest of the content.

## 3. Considerations on the qualification records

- **1st opportunity qualification record.** The global mark will be the weighted sum of those obtained in all the assessments carried out (practical classes, project, partial exam and final exam), provided that the minimum required grades have been passed (4 points out of 10 in practical classes and project, 5 points out of 10 in partial and final exams). In case of failing or not showing up for the partial and/or final exam, the record will reflect the Fail rating, with a numerical value resulting from the weighted sum of the practical classes and project grades, applying the global grade contribution percentages specified in this guide; the contents approved in these two sections will be considered as passed with a view to the 2nd opportunity qualification record.
- **2nd opportunity qualification record.** The global mark will be the weighted sum of those obtained in all the assessments carried out, provided that the minimum required marks have been passed. In case of failing or not taking the final exam, the record will reflect the Fail grade, with a numerical value resulting from the weighted sum of the practical classes and project grades, applying the global grade contribution percentages specified in this guide.

## 4. Ethical considerations

The student is expected to exhibit an adequate ethical behavior. In case of detecting unethical behavior (copying, plagiarism, use of unauthorized electronic devices, and others), it will be considered that the student does not meet the necessary requirements to pass the subject. In this case, the overall grade in the current academic year will be Fail (0.0).

The use of any electronic device during the evaluation tests will not be allowed unless expressly authorized. The introduction of a non-authorized electronic device in the exam room will be considered a reason for not passing the subject in this academic year and the overall rating will be Fail (0.0)

**Updated exam calendar:** <https://eei.uvigo.es/gl/alumnado/planificacion-academica/calendario-de-exames/>

**Lecturer acting as course coordinator:** María Asunción Longo González

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**Sources of information**

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**Basic Bibliography**

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Henry C. Vogel; Celeste L. Todaro, **Fermentation and biochemical engineering handbook: principles, process design and equipment**, 3ª, Elsevier, 2014

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Michael R. Ladisch, **Bioseparations engineering : principles, practice, and economics**, 1ª, Wiley, 2001

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Wim Soetaert, Erick J. Vandamme, **Industrial biotechnology : sustainable growth and economic success**, 1ª, Wiley-VCH, 2010

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Robin Smith, **Chemical process design and integration**, 2ª, John Wiley & Sons, 2016

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José A. Teixeira; Antonio A. Vicente, **Engineering aspects of food biotechnology**, 1ª, CRC Press, 2014

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José López Carrascosa y Aurelia Modrego, **La biotecnología y su aplicación industrial en España**, 1ª, Universidad Carlos III, 1994

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OECD, **The application of Biotechnology to industrial Sustainability**, 1ª, OECD Publishing, 2001

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**Complementary Bibliography**

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**Recommendations**

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**Subjects that continue the syllabus**

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Modelling of biotechnological processes/V12G350V01924

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**Subjects that are recommended to be taken simultaneously**

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Product optimisation/V12G350V01701

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

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Chemical engineering 1/V12G350V01405

Chemical engineering 2/V12G350V01503

Reactors and biotechnology/V12G350V01601

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