



Universitat de Lleida

# DEGREE CURRICULUM

# **INDUSTRIAL APPLICATIONS OF BIOTECHNOLOGY**

Coordination: VILLORBINA NOGUERA, GEMMA

Academic year 2023-24

## Subject's general information

Subject name	INDUSTRIAL APPLICATIONS OF BIOTECHNOLOGY				
Code	101635				
Semester	1st Q(SEMESTER) CONTINUED EVALUATION				
Typology	Degree		Course	Character	Modality
	Bachelor's Degree in Biotechnology		4	OPTIONAL	Attendance-based
Course number of credits (ECTS)	6				
Type of activity, credits, and groups	Activity type	PRACAMP	PRALAB	PRAULA	TEORIA
	Number of credits	0.6	1.2	1.8	2.4
	Number of groups	1	2	1	1
Coordination	VILLORBINA NOGUERA, GEMMA				
Department	ENVIRONMENT AND SOIL SCIENCES AND CHEMISTRY				
Teaching load distribution between lectures and independent student work	56 teaching hours 94 student dedication				
Important information on data processing	Consult <a href="#">this link</a> for more information.				
Language	Català 95% English 5%				

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
MORATO-ARAGONES IBAÑEZ, GUILLEM	guillem.morato-aragones@udl.cat	1,2	
OSORIO VIANA, WILMAR	wilmar.osorio@udl.cat	1,2	
VILLORBINA NOGUERA, GEMMA	gemma.villorbina@udl.cat	4,8	

## Subject's extra information

Students must bring the following individual protection items (EPI) in the course of laboratory works:

- White lab coat UdL unisex
- Safety glasses
- Chemical protection gloves

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

<http://www.publicacions.udl.cat/>

In any case, the Department of Chemistry, Physics, Ambiental and Soil Sciences will try to put at the disposal of the students glasses and gloves of protection of general use.

### GENERAL SAFETY RULES IN LABORATORY PRACTICES

Maintain the place of performance of clean and tidy practices. The work table must be free of backpacks, folders, coats ...

In the laboratory you can not come with shorts or short skirts.

Bring closed and covered shoes during the performance of the practices.

Bring long hair always collected

Keep the gowns cords to protect against spills and spills of chemical substances.

Do not carry wide bracelets, pendants or sleeves that can be trapped by the equipment, assemblies ...

Avoid wearing contact lenses, since the effect of chemicals is much greater if they are introduced between the contact lens and the cornea.

Do not eat or drink in the laboratory

Smoking is prohibited within laboratories

Wash your hands whenever you have contact with a chemical and before leaving the laboratory.

Follow the teacher's instructions and consult any questions about security.

## Learning objectives

### The student who passes the subject must know: (Knowledge Objectives)

- What does the concept of biorefinery imply?
- Possible sources of renewable materials
- Type of most important applications
- Methodologies for its transformation into products with economic interest.
- Environmental aspects linked to these processes
- Opportunities and limitations of biomass-based products.

### The student who passes the course must be able to: (Capacity Objectives)

- Make decisions about the opportunity and possibility of obtaining a product based on biomass.
- To be able to advise on possible new opportunities in obtaining products based on biomass.
- To be able to join research groups working in this field.
- To be able to integrate in companies dedicated to the obtaining of products related to the subject matter of the course.
- Understand and be able to analyze scientific articles related to the subject matter.

## Competences

### General competences

#### The graduate in Biotechnology has to:

- CG1. To be able to search and selectively use sources of information necessary to achieve the training objectives.
- CG2. To interpret scientific-technical information with a critical sense, and to be able to make presentations based on this information.
- CG3. To work as a team, with a multidisciplinary vision and the ability to make a rational and effective distribution of tasks among the members of the team.
- CG4. To know and use adequately the scientific and technical vocabulary of the different fields of Biotechnology.
- CG5. To work in the laboratory applying criteria of quality and good practice.
- CG9. To be able to carry out a professional activity in accordance with safety and environmental regulations and ethical criteria.
- CG11. To acquire criteria for choosing the most appropriate analytical techniques for each specific practical case.

### Specific competences

- CE34. To know the main areas of application of Biotechnology and acquire basic expertise in some of them.
- CE44. To be able to design the protocol of a specific biotechnological process. Fulfil the practical requirements necessary to carry it out and the parameters for its evaluation.

### Transversal competences

- CT1. To be able to make understandable written and oral reports on the work carried out, with a justification based on the theoretical-practical knowledge reached.
- CT3. To use tools and techniques of information and communication for the analysis of data and the elaboration of oral and written reports and other formative and professional activities.

## Subject contents

### --Topics--

#### Introduction

Presentation of the subject: evaluation criteria, dates to take into account, introduction to the Horizon Europe program and the bioeconomy (or circular economy).

## **Historical perspective of industries based on the use and transformation of biomass to obtain products and materials.**

From the 19th to the 21st century. Fossil reserves and their depletion. Environmental aspects. Parameters for measuring the impact of a process (the E factor; atomic savings and life cycle analyses). Need to use renewable sources. The three main areas of human consumption of products and materials: as a source of energy, as a source of materials, as a source of bioactive products. Biomass as the main renewable source: problems and challenges. The exploitation of microalgae as an example.

## **Possibilities of using biotechnological tools in the transformation of biomass.**

Traditional fermentation processes. Current tools to improve processes. Biocatalysts. Cellular machines. Applications in the preparation of chemical products. The use of a product such as glycerol.

## **Biofuels**

Main types of biofuels. Distribution of renewable resources. Capacity of biomass to supply us with energy. Second and third generation biofuels. Processes for obtaining them. Market possibilities for biofuels. Environmental aspects to be taken into account.

## **Biopolymers and bioplastics**

Monomers and biopolymers. Characteristics of plastics. Biodegradable plastics. Processes to obtain them. Application of biotechnology in their production. Applications of biopolymers and bioplastics and possible problems.

## **Secondary metabolites as a source of new products.**

Agronomic and pharmaceutical uses of secondary metabolites. The study of ancestral customs for the development of useful products. Medicinal plants as a source of active principles. Isolation and structural modification of secondary metabolites. The search for new secondary bioactive metabolites.

## **Additives**

Flavouring dyes and preservatives. Possible sources of additives. Processes for obtaining them. Application of biotechnology in its production. Glycerol as a source of some additives: mono- and diglycerides. Unicellular proteins: fungus, yeasts and bacteria.

## **New horizons in the use of biomass: biotemplates.**

Biomass as a source of inspiration in the design and preparation of new materials and new technologies. Photocatalytic production of hydrogen. CO<sub>2</sub> reduction. Solar cells. Lithium ion batteries. Photocatalytic degradation. Gas / steam sensors.

## **--Practical activities--**

### **Seminar**

Elaborate two writing work about 2 scientific publications proposed by the professors.

Presentation related to the subject within the framework of the Horizon Europe Program. The action must be based

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on a minimum of two scientific publications and must be defended in public with a duration of 10 min explaining the motivation, rationale and conclusions.

## Laboratory practices

Practice 1: Treatment of biomass by applying sustainable processes.

Practice 2: Applications of biocatalysts for the preparation of compounds with industrial interest.

## Visit:

Visit to industrial plant devoted to recover natural products from algae.

## Methodology

Type of activity	Description	Semi-attendance activity student		Non-face-to-face activity student		Evaluation	Total time
		Objectives	Hours	Student work	Hores	Hours	Hours
<b>Lecture</b>	Lecture (Classroom. Large group)	Explanation of the main concepts	28	Study: Know, understand and synthesise knowledge	32	4	64
<b>Seminar</b>	Participative class (Medium group)	Conducting discussion or application	4	Solve problems and cases. Discuss.	15	0	19
<b>Laboratory</b>	Laboratory practicals (Medium group)	Execution of the practical: understanding phenomena, measuring...	12	Carry out practical exercises and memory. Drawing conclusions.	12	0	24
<b>Visits</b>	Industry visit	Carrying out the visit	6	carrying out the report	9	0	15
<b>Activities directed</b>	Student work (individual or group)	Guiding the student in the work (in tutoring hours)	10	Carry out a bibliographic work, practical, etc.	20	0	30
<b>Total</b>			60		90	4	150

## Evaluation

Tests	Practices	Other activities
50	15	35

Activity	Description	Number	%
<b>Theory</b>	Written tests (true/false) on the theory of the subject	2	50
<b>Laboratory</b>	Delivery of memory	1	15
<b>Seminar</b>	Oral presentation	1	15

<b>Visit</b>	Delivery of memory	1	5
<b>Written activity</b>	critical review of an article. Delivery of memory	2	15 (5+10)
<b>Total</b>			100

## Alternative assessment

If alternative assessment is used, the following activities must be carried out in order to pass the course:

- Carry out the practical laboratory sessions and submit the report 20%
- Present the work report of the chosen article 20%
- Take the final exam on the last day of the course 60%.

## Bibliography

### Basic references

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Feliu Jofre, A.; Flotats Ripoll, X. **2020** *Renewable gases. An emerging energy vector* Naturgy Foundation Avda. San Luís:Madrid ISBN: 978-84-09-20931-6.

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