

Industrial Production of Bioproducts

Code: 43324
ECTS Credits: 6

Degree	Type	Year	Semester
4314579 Biological and Environmental Engineering	OB	1	1

Contact

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Use of Languages

Principal working language: spanish (spa)

Teachers

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Prerequisites

To follow the module it is necessary to have a basic formation in Biochemical Engineering, in fundamental aspects of Bioprocess Engineering, in Bioreactors and some very basic concepts of recombinant DNA and Genetic Engineering.

Objectives and Contextualisation

The objective of this module is to familiarize the student with the most important tools used in a bioprocess, and its application in the design and operation of bioprocesses in their future professional careers. In order to achieve this objective, different cellular factories will be explored, designed, integrated and optimized for producing industrial biotechnological products, integrating the production and purification of the bioproduct in a reproducible way (BIOPAT concept) and economically viable Bioprocess Engineering. The quality and safety regulations of bioproducts from different fields will also be explained and the principles on which the scale up of a bioprocess is based will be presented.

Competences

- Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of biological and environmental engineering.
- Continue the learning process, to a large extent autonomously.
- Integrate and use biotechnology and bioprocess engineering tools to solve problems in emerging biotechnological areas for the industrial production of bioproducts.
- Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
- Seek out information in the scientific literature using the appropriate channels and integrate this information, showing a capacity for synthesis, analysis of alternatives and critical debate.

- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Work in a multidisciplinary team

Learning Outcomes

1. Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of biological and environmental engineering.
2. Continue the learning process, to a large extent autonomously.
3. Define and protocolise experimenting and production in accordance with BPL norms.
4. Describe BioPAT methodology.
5. Describe and apply the design based on the quality of a bioprocess (Q&D).
6. Describe and apply the norms on correct production to safeguard human and animal health.
7. Identify the advantages, disadvantages and engineering of the bioprocess of animal and plant cells as a cell factory.
8. Identify the advantages, disadvantages and engineering of the bioprocess of the eukaryotic cell factory *P.pastoris*.
9. Identify the advantages, disadvantages and engineering of the bioprocess of the prokaryotic cell factory *E. coli*.
10. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
11. Recognise the problem of change of scale in biotechnology.
12. Seek out information in the scientific literature using the appropriate channels and integrate this information, showing a capacity for synthesis, analysis of alternatives and critical debate.
13. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
14. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
15. Work in a multidisciplinary team
16. Write standard working protocols

Content

- 1.- Introduction to the industrial production of bioproducts. Scale up in bioreactors
- 2.- Bioprocess design based on quality.
 - 2.1.- Quality by Design (QbD) / Process Analytical Technology (PAT)
 - 2.2.- Good Manufacturing Practice (GMPs). Good Laboratory Practices (BPLs),
- 3.- Cell factories: Animal cell culture
- 4.- Cell factories: *Pichia pastoris*.
- 5.- Cell factories: *Escherichia coli*.

Methodology

Theory classes: lectures on the concepts of the syllabus.

Seminars: Seminars on the aspects of the industrial world of Biotechnology carried out by experts invited from the sector

Group work activity. Students will prepare a report on a topic related to the content proposed by the teacher.

These works will be exhibited and defended in public.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	31	1.24	1, 12, 3, 16, 5, 6, 4, 8, 9, 7, 10, 13, 2, 11, 14
Seminars	8	0.32	10, 13, 2
Type: Supervised			
group work	35	1.4	1, 12, 10, 13, 2, 14, 15
Type: Autonomous			
Search of documentation and bibliography	24	0.96	12, 10, 13, 2, 14
Study	47.5	1.9	1, 12, 3, 16, 5, 6, 4, 8, 9, 7, 10, 13, 2, 11, 14

Assessment

Continuous assessment

Individual written evaluation: It is 70% of the final grade. Four partial tests corresponding to different subjects of the course are carried out with a weight of 25% each of them. If in the individual written evaluation the student obtained a grade lower than 3/10, he will not pass the module.

Evaluation of the defense and oral presentation of a research paper (30%)

Final evaluation:

Students who do not pass the continuous assessment will have a global test of written individual final recovery. Whenever this test is exceeded with a grade higher than 3/10, it will be done with the grade of the oral presentation.

See more details in the spanish version

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Oral presentation assessment	30%	0.5	0.02	1, 12, 10, 13, 2, 14, 15
Writing exam 1	17,5%	1	0.04	1, 3, 16, 5, 6, 4, 8, 9, 7, 10, 13, 2, 11, 14
Writing exam 2	17,5%	1	0.04	1, 3, 16, 5, 6, 4, 8, 9, 7, 10, 13, 2, 11, 14
Writing exam 3	17,5%	1	0.04	1, 3, 16, 5, 6, 4, 8, 9, 7, 10, 13, 2, 11, 14
Writing exam 4	17,5%	1	0.04	1, 3, 16, 5, 6, 4, 8, 9, 7, 13, 2, 11, 14

Bibliography

The bibliography needed to follow the module can be consulted through the virtual platform. In parallel, the student will have to carry out searches and specific bibliographical consultations for the elaboration of their group work.