Universitat Autònoma de Barcelona

2022/2023

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

Francesc Gòdia Casablancas

José Luis Montesinos Seguí

Francisco Valero Barranco

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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 and use chemical, environmental and/or biological engineering tools to design biological systems for the sustainable processing of waste and/or for industrial biotechnological processes.
- 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. Design and manage a research project in the field of environmental and biological engineering.
8. Identify the advantages, disadvantages and engineering of the bioprocess of animal and plant cells as a cell factory.
9. Identify the advantages, disadvantages and engineering of the bioprocess of the eukaryotic cell factory P.pastoris.
10. Identify the advantages, disadvantages and engineering of the bioprocess of the prokaryotic cell factory E. coli.
11. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
12. Recognise the problem of change of scale in biotechnology.
13. 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.
14. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
15. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
16. Work in a multidisciplinary team
17. Write standard working protocols.

Content

1.- Introduction to the industrial production of bioproducts. Scale up in bioreactors

2.- Bioprocess design based on quality: QbD.

2.1.- Good Manufacturing Practice (GMPs). Good Laboratory Practices (BPLs)

2.2.-Quality by Design (QbD) / Process Analytical Technology (PAT)

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. These works will be exposed and defended in public, and will consist of a work on a scientific paper proposed by the professor.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	31	1.24	1, 13, 3, 17, 5, 6, 4, 9, 10, 8, 11, 2, 12, 15
Seminars	8	0.32	11, 2
Type: Supervised			
group work	35	1.4	1, 13, 11, 2, 15, 16
Type: Autonomous			
Search of documentation and bibliography	24	0.96	13, 11, 2, 15
Study	47.5	1.9	1, 13, 3, 17, 5, 6, 4, 9, 10, 8, 11, 2, 12, 15

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, 13, 7, 11, 2, 15, 16

Writing exam 1	17,5%	1	0.04	1, 3, 17, 5, 6, 4, 9, 10, 8, 11, 14, 2, 12, 15
Writing exam 2	17,5%	1	0.04	1, 3, 17, 5, 6, 4, 9, 10, 8, 11, 14, 2, 12, 15
Writing exam 3	17,5%	1	0.04	1, 3, 17, 5, 6, 4, 9, 10, 8, 11, 14, 2, 12, 15
Writing exam 4	17,5%	1	0.04	1, 3, 17, 5, 6, 4, 9, 10, 8, 2, 12, 15

Bibliography

General bibliography:

Liu, Sh. Bioprocess Engineering. Kinetics, "Sustainability, and Reactor Design." Elsevier B.V. 2nd ed. (2017). Digital version.

Berenjian, A. "Essentials in Fermentation Technology". Springer. (2019). Digital version.

Elmar Heinzle, Arno P. Biwer, Charles L. Cooney "Development of sustainable bioprocesses: modeling and assessment". John Wiley & Sons, Ltd. 2006. Digital version

Pauline M. Doran. "Bioprocess Engineering Principles" . Academic Press. (2013). Digital version

The rest of the bibliography used for each part of the module is mainly articles or journal reviews and is specified and included in the Campus Virtual.

Software

It is not planned to use any software specific to the subject, beyond the basics of MS office. (word, powerpoint)