UAB
Universitat Autònoma de Barcelona

Biocatalytic Processes and Green Chemistry

Code: 107535
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500253 Biotechnology	OT	4

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

To achieve the objectives of the subject, it is recommended to have solid knowledge in:

Biochemistry

Enzyme kinetics

Microbial kinetics

Cell biology

Enzymology

Structure/function relationship of proteins

Bioreactors

Organic chemistry

Objectives and Contextualisation

The objective is to address the development of biocatalytic processes as more sustainable processes for industry. First, the basic concepts of biocatalysis and green chemistry will be defined. Subsequently, process metrics will be defined and how, based on these, process intensification is carried out. In this sense, the study of the design of the biocatalyst will be essential, focusing mainly on immobilization methodologies. It is fundamentally intended to know how to establish the relationship between the nature of the biocatalyst used, the different immobilization methods available and the final application that is intended to be developed, analyzing different alternatives and modifications in the design of the particles and of the final system to be developed. Finally, knowledge will be given in alternative reaction media as well as in multi-enzymatic systems.

Learning Outcomes

1. CM32 (Competence) Plan a process for obtaining biotechnological products.
2. CM32 (Competence) Plan a process for obtaining biotechnological products.
3. CM33 (Competence) Design the different stages necessary to obtain products by biotechnological means.
4. CM33 (Competence) Design the different stages necessary to obtain products by biotechnological means.
5. CM34 (Competence) Design all the stages of obtaining biotechnological products or derivatives taking into account ethical and sustainable development aspects.
6. KM36 (Knowledge) Describe the bases of the design of a biotechnological production process, as well as its environmental implications.
7. SM32 (Skill) Apply safety standards both in the laboratory and in the design of biotechnological plants.
8. SM32 (Skill) Apply safety standards both in the laboratory and in the design of biotechnological plants.

Content

- Introduction to Biocatalysis and green chemistry

- Intensification of biocatalytic processes

- Biocatalyst engineering

- Reaction medium engineering

- Multi-enzymatic systems

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory	15	0.6	CM32, CM33, SM32
Theory	36	1.44	CM32, CM33, CM34, KM36
Type: Supervised			

Oral presentations	2	0.08	CM32, CM33, CM34, KM36
Type: Autonomous			
Laboratory reports	9	0.36	CM32, CM33
Report writting	22.5	0.9	CM32, CM33, CM34, KM36
Study	49	1.96	CM32, CM33, CM34, KM36

Directed activities:

- Theoretical lessons: Lectures on the concepts of the subject
- Laboratory practices: Students will carry out laboratory practices in which they will acquire practical experience in biocatalyst immobilization.

Supervised activities:

- Public presentation of work: Students will present orally (10-20 minutes) and publicly a summary of the most relevant results of the work on immobilization techniques and deliver the presentation in digital format to the teacher via the virtual campus. Both the documentation of the works and the oral presentations are part of the content of the subject and are therefore subject to examination

Independent activities:

- Student study: Individual study and preparation of outlines and summaries
- Elaboration of practice report: group work of 2-4 students in which each group will prepare a report with the results obtained in the laboratory practices and deliver the report to the teacher in paper format (printed) and in digital format via the virtual campus
- Writing assignments: group work of 2-4 students in which each group will produce two written assignments. A work on immobilization techniques and another on biocatalysts. Both assignments must be submitted to the teacher in paper (printed) format and in digital format via the virtual campus. Both the documentation of the works and the oral presentations are part of the content of the subject and are therefore subject to examination.

Informative note: the teaching staff will allocate about 15 minutes of some class to allow the students to answer the evaluation surveys of the teaching performance and of the subject

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.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam	45%	2	0.08	CM32, CM33, CM34, KM36
Laboratory practices reports	25%	4	0.16	CM32, CM33, CM34, KM36, SM32
Oral presentation	10%	0.5	0.02	CM32, CM33, CM34, KM36
Report	10%	5	0.2	CM32, CM33, CM34, KM36

Report on immobilization	10%	5	0.2	CM32, CM33, CM34, KM36

Evaluation process and activities

Throughout the course, different assessment activities will be carried out that will result in the final grade of the subject obtained through continuous assessment. Specifically, the evaluable activities will be:

• Written work which is 15% of the final grade. The minimum mark for not having to retake this work is a 4

• Laboratory practices which is 25% of the final grade. The subject cannot be passed if the laboratory practices are not approved (minimum grade of 5)

• Written work on biocatalyst immobilization techniques which is 15% of the final grade. The minimum mark for not having to retake this work is a 4

• Oral presentation which is 5% of the final mark

• Synthesis exam which is 40% of the final grade. The subject matter of the summary exam is the course syllabus. The minimum grade for not having to retake this exam is a 4.

The laboratory practices and the oral presentation of the work on immobilization techniques are non-refundable.

The subject is considered passed if the average of the 5 evaluable activities is 5 or higher provided that no activity has a grade lower than 4.

If any of the following circumstances occur, it implies a grade of Not Assessable in the subject:

• Not taking the synthesis exam

• Not doing laboratory practices

• Not presenting both works

No grades are saved for the next year.

Bibliography

Copeland, Robert Allen. 2023. Enzymes : a practical introduction to structure, mechanism, and data analysis / Robert Allen Copeland. John Wiley & Sons.

Dixon, Malcol. 1979. Enzymes. London.

Linqiu, Cao. 2005. Carrier-bound immobilized enzymes : principles, applications and design. Weinheim : Wiley-VCH,

Illanes, Andres. 2008. Enzyme biocatalysis : principles and applications. Springer

Bommarius, A.S.; Riebel, B.R. 2004. Biocatalysis: fundamentals and applications

Mosbach, Klaus. 1997. Immobilized enzymes and cells. Academic Press.

Bickerstaff, G. 1997. Immobilization of enzymes and cells. Humana Press.

Guisan, JM.; Bolivar, JM.; López-Gallego, F.; Rocha-Martín, J. 2020. Immobilization of Enzymes and Cells: Methods and Protocols. Springer.

Faber, K. 2018. Biotransformations in Organic Chemistry: A Textbook. Springer

Scientific searchers:

Scholar Google: http://scholar.google.es/advanced_scholar_search?hl=en&lr=
Scopus: http://www.scopus.com/scopus/search/form.url?display=authorLookup
Scifinder: Software disponible a la UAB
Sience Direct: http://www.sciencedirect.com/science/journals
ISI Web of Knowledge: http://www.accesowok.fecyt.es/login/

Webs of interest:

Enzyme database: BRENDA: http://www.brenda-enzymes.info/
National Center for Biotechnology Information: http://www.ncbi.nlm.nih.gov/
ExPASy (Expert Protein Analysis System) Proteomic Server: http://www.expasy.ch/

Software

Microsoft Office

Language list

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	441	Spanish	second semester	afternoon
(SEM) Seminars	441	Spanish	second semester	morning-mixed
(TE) Theory	44	Spanish	second semester	morning-mixed