Universitat Autònoma de Barcelona

2020/2021

Pilot-scale or Industrial-scale Practical Studies

Code: 43331
ECTS Credits: 6

Degree	Type	Year	Semester
4314579 Biological and Environmental Engineering	OB	1	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: spanish (spa)

Other comments on languages

This subject in entirely taught in Spanish

Teachers

Gloria González Anadón

Montserrat Sarra Adroguer

Antoni Casablancas Mira

Raquel Barrena Gomez

Prerequisites

Having completed the subjects 43323 - Design and Operation of Water Treatment Systems, 43322 - Bioprocess

Objectives and Contextualisation

The objective of this module is to integrate, in a practical way, the knowledge of the different subjects acquired by the student in the previous studies and combine them with new knowledge that is provided to the student in the context of the master.
On the one hand, the production of a protein at pilot-scale will be carried out in a pilot plant for the production of biotechnological products for food and diagnostics. The student must acquire understanding and practice in the analysis, design and operation of biotechnological processes in engineering terms while trying to comply with the regulations and standards of quality and safety of products for various uses (health and human and animal food, environmental, industrial, etc).
On the other hand, biological systems for the treatment of solid waste and wastewater at industrial scale will be studied. The objective is to familiarize the student with the stages of each process and the most important analytics to determine their efficiency, in order to be able to use these tools in the design and operation of environmental soundly treatment processes.

Competences

- Apply methods, tools and strategies to develop biotechnological processes and products with energy-saving and sustainability criteria.
- Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of biological and environmental engineering.
- Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
- Continue the learning process, to a large extent autonomously.
- Define and design the characteristic separation sequences in chemical, biotechnological and environmental processes in order to increase separation yields, applying criteria of energy optimisation.
- Design and operate systems of purification of urban and industrial waste waters.
- 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 biological engineering tools to design biological systems for the sustainable processing of waste and 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.
- Organise, plan and manage projects
- 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.
- Use knowledge of chemical engineering to design and optimise processes of pollution remediation in natural environments.
- Work in a multidisciplinary team

Learning Outcomes

1. Apply energy-saving and sustainability criteria to biotechnological and environmental processes.
2. Apply separation operations in biotechnological and environmental processes.
3. Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of biological and environmental engineering.
4. Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
5. Continue the learning process, to a large extent autonomously.
6. Design and operate an industrial process to obtain biotechnological products.
7. Design production systems and equipment for bioproducts of different biotechnological sectors, paying attention to process and product quality and displaying a holistic perspective on the bioprocess.
8. Identify and operate polluted waste-water treatment systems, showing a holistic perspective on the process.
9. Identify systems for treating polluted natural environments, showing a holistic perspective on the process.
10. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
11. Organise, plan and manage projects
12. Present the practical work done orally and in writing.
13. Recognise the work of a pilot fermentation plant and apply its working rules.
14. Recognise the work of a pilot natural environment treatment plant and apply its working rules.
15. Recognise the work of a pilot waste-water treatment plant and apply its working rules.
16. 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.
17. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
18. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
19. Work in a multidisciplinary team

Content

The planned contents are as follows, but possible restrictions imposed by health authorities may require prioritiza

1. Practical operation of a bioprocess in a pilot plant

- Familiarization with the operational blocks of the pilot plant.
- Upstream and auxiliary systems: preparation of media and bioprocess equipment. Sterilization of 2L and 50L bioreactors. Preparation of inocula.
- Analytical follow-up of the physicochemical and biological variables of the process.
- Downstream: solid-liquid separation, cell disruption, precipitation, microfiltration, concentration and dialysis by ultrafiltration, ion exchange chromatography and gel filtration.
- Monitoring and analysis of the product to determine the degree of purity and the yields achieved.

2. Practical demonstration of biological systems for solid waste treatment and wastewater treatment at industrial scale.

- Familiarization with the process diagrams and the functioning of the different subunits.
- Analytical characterization of the input and output flows of the process.
- Monitoring of the physicochemical and biological variables of the process.
- Determination of the elimination performance of the contaminants.

Methodology

The proposed teaching methodology may experience some modifications depending on the restrictions to face-to

It is a compulsory the attendance to the subject due to its hands-on character in the laboratory.

Safety measures should be followed all the time.

It is extremely important to follow the safety and hygiene rules arising from the exceptional situation of COVID-19

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Completion of experiments	54	2.16	1, 3, 2, 16, 12, 8, 9, 11,

			10, 4, 17, 5, 13, 15, 14, 18, 19
Presentation of the experiments and operation of the laboratory. Distribution of the groups.	2	0.08	11, 5, 19
Type: Supervised			
Preparation and completion of the exam	12	0.48	1, 2, 6, 7, 12, 8, 9, 11, 10, 4, 17, 13, 15, 14, 18
Type: Autonomous			
Preparation of documents that include the results of the experiments (reports, standardized work protocols and poster)	54	2.16	1, 3, 2, 16, 12, 8, 9, 11, 10, 4, 17, 5, 13, 15, 14, 18, 19

Assessment

The specific details of the assessment of this subject can be found in the Catalan or Spanish version of this document. If necessary, you can contact the faculty responsible for the subject.

Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Individual exam	30	5	0.2	1, 2, 6, 7, 12, 8, 9, 11, 10, 4, 17, 13, 15, 18
Oral presentation	20	3	0.12	16, 12, 4, 19
Preparation of documents that include the results of the experiments (reports, standardized work protocols and poster)	50	20	0.8	1, 3, 2, 16, 12, 8, 9, 11, 10, 4, 17, 5, 13, 15, 14, 18, 19

Bibliography

- Metcalf & Eddy Inc. Wastewater Engineering: Treatment and Reuse. 4th Edition. Ed. Mc. Graw-Hill Inc., N.Y. (2003). ISBN: 0071122508.
- Mark C. M. van Loosdrecht, Per H. Nielsen, Carlos M. Lopez-Vazquez, Damir Brdjanovic. Experimental Methods in Wastewater Treatment. IWA Publishing (2016). ISBN: 9781780404745 (Hardback). ISBN: 9781780404752 (eBook). https://www.researchgate.net/publication/299830736_Experimental_Methods_in_Wastewater_Treatment
- Juan M. Lema, Sonia Suarez (ED). MartinezInnovative Wastewater Treatment & Resource Recovery Technologies: Impacts on Energy, Economy and Environment. ISBN: 9781780407869 (paperback). JOSE MARIO DIAZ FERNANDEZ (Cood). Ecuaciones y cálculos para el tratamiento de aguas. ISBN: 9788428341523.