Universidad Zaragoza

Academic Year/course: 2024/25

27124 - Bioreactors

Syllabus Information

Academic year: 2024/25
Subject: 27124 - Bioreactors
Faculty / School: 100 - Facultad de Ciencias
Degree: 446 - Degree in Biotechnology
ECTS: 6.0
Year: 4
Semester: First semester
Subject type: Compulsory
Module:

1. General information

The subject and its expected results aim for the students to be able to: 1. Handle the basic concepts and nomenclature in Biochemical Reaction Engineering.

2. Propose, develop and solve kinetic models describing enzymatic and microbial processes.

3. Know the mechanisms of immobilization of biocatalysts, and the phenomena of mass transfer in reactors with immobilized biocatalysts.

4. Know and apply the basic equations for the design and optimization of biochemical reactors.

5. Know how to select the most suitable type of bioreactor for a given production.

These concepts would contribute to achieving the Sustainable Development Goals (SDGs): 2, 3, and 6 of the 2030 Agenda.

2. Learning results

The learning results are necessary to **be able to conceive, design, optimize and operate the different types of basic industrial bioreactors**. Therefore, in order to pass this subject, the student must demonstrate the following results:

- To know the different types of bioreactors and their main operating characteristics.

- To know the main kinetic models applicable to enzymatic and microbial processes.

- To know and apply the different methods for estimating kinetic parameters.

- To know and apply the equations for the basic design of enzymatic and microbial bioreactors.

- To know the basic methods of selection and optimization of ideal reactors.

- To know and select the different methods of immobilization of biocatalysts.

3. Syllabus

The learning results will be achieved through the development of the following content program: Topic 1. Introduction to the Engineering of Biochemical Reactions.

Topic 2. Enzyme Kinetics and Catalysis. Determination of kinetic parameters. Kinetics of cooperative reversible reactions. Inhibition and deactivation.

Topic 3. Microbial Kinetics. Malthus, Logistic and Gompertz models. Monod model.

Topic 4. Immobilization of enzymes and biocatalysts. Immobilization technology. Types and immobilization method selection. Effects of immobilization on mass transfer.

Topic 5. Design of continuous and discontinuous enzymatic bioreactors.

Topic 6. Design of continuous and batch microbial fermenters.

4. Academic activities

The program offered to the student to help them to achieve the expected results comprises the following activities:

- Sessions of explanation of the theoretical contents, in which the concepts of the course are presented (38 classroom hours)

- Classes dedicated to problem solving, in which student participation will be encouraged. Resolution of numerical problems and methodological processes with the participation of the students (18 classroom hours).

- Laboratory practices. In this part of the subject, the participants will learn and use different experimental techniques for the immobilization of biocatalysts as part of laboratory work (4 hours).

5. Assessment system

Option 1: The assessment is continuous and includes: **Laboratory practices**. Attendance, presentation of a brief report of the activity, as well as the presentation/interpretation of the results will be scored. **Completion of problems delivered**, graded by evaluating their content, the understanding of the concepts demonstrated in them and the correct presentation. An **exam** at the end of the term. This test will consist of: (a) questions and reasoned theoretical and theoretical-practical issues in which the application of theory to specific cases and examples will be requested, and (b) problem solving. The grade for the subject will be calculated according to the following formula: **Final grade = 0.1 P + 0.1 T+ 0.8 E** where: P is the grade for the laboratory practices, T is the grade for the problems handed in, and E is the grade for the final exam. A minimum exam grade, E, of 4.0 out of 10 is required in order to average and pass the subject.

Option 2: Those students who wish to do so may choose to take a global exam that will include the practical part. A minimum grade of 5.0 out of 10 on this exam is required to pass the subject.

6. Sustainable Development Goals

2 - Zero Hunger
3 - Good Health & Well-Being
6 - Clean Water and Sanitation