UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Industrial Biotechnologies For Chemicals and Bioenergies

2122-2-F5401Q055

Aims

The course aims to introduce topics and problems related to basic and applied research related to the use of natural microorganisms for classical fermentation biotechnologies.

1. Knowledge and understanding.

At the end of the course the student will know the microbiological and process general bases for understanding the growth of a microorganism in a biorector; he/she will gain how to recognize the advantages of different bioreactor technologies, growth techniques and the basic principles for the immobilization of enzymes. The student will gain the ability to understand the general principles of the biotechnology industry in different fields such as food, pharmacological and health products, in the production of fine chemicals, but also for processes to protect the environment and recover of energy (Circular Bioeconomy). The course includes practical teachings.

2. Applying knowledge and understanding.

At the end of the course the student will be able to apply the acquired knowledge above described to biosynthetic methodologies for basic research and industrial processes.

3. Making judgments.

The student must be able to process what learned and be able to recognize the processes and problems of the industrial microbiology.

4. Communication skills.

Use of an appropriate scientific vocabulary and ability in written and oral reports.

5. Learning skills.

At the end of the course the student will be able to read the literature on the topics covered and will be able to analyse, use and integrate the knowledge acquired with what will be learned in lessons related to the production of chemical products of interest for the biotechnology industry.

Contents

1. The Bioreactor.
2. Monitoring and control of the parameters
3. Immobilized enzymes
4. Biotechnology of classic fermentations.

Detailed program

1. The Bioreactor.
Ideal features for an industrial microorganism. Bioreactor technologies for cultures of microorganisms. Sterility and safety, heat transfer, oxygen transfer, homogeneity. Main fermentative techniques: batch culture, continuous cultivation, fed-batch culture. Composition and development of culture media. Scale-up.
2. Monitoring and control of the parameters.
Measured, determined and calculated parameters. Aggregated and segregated parameters. Fermentation control.
3. 3. Immobilized enzymes.
Immobilization methods. Advantages and disadvantages. Applied examples.
4. Biotechnology of classic fermentations.
Carbon metabolism. Comparative analysis of central metabolism of microorganisms. Mass and energy balances. Production of organic acids (lactic acid, citric acid). Solvent production (Ethanol).

Prerequisites

To have acquired the contents and passed the classical teachings of General Biochemistry.

Teaching form

The methodological approach involves a historical reconstruction of the progress of knowledge accompanied by an analysis of the logical process that guided the experimentation and that led to the understanding of the mechanisms underlying the bioprocesses. The educational activities will take the form of lectures and practical experiences.

Textbook and teaching resource

The Course will be carried out with the aid of slides and exercises on the blackboard or electronic facilities. All projected teaching material is made available to the students.

Semester

Secon semester, II year course

Assessment method

The assessment of the knowledge learned will be carried out by an oral exam at the end of the course. During the test, the student will have to face at least two questions aimed at verifying the knowledge of the course. The test has a duration of about 30 minutes.

Office hours

Contact: on demand, upon request by mail to lecturer or during the lecture.