

Course Unit	Bioreactors	Field of study	Chemical Processes Technologies
Master in	Environmental Technology	School	School of Agriculture
Academic Year	2023/2024	Year of study	1
Type	Semestral	Semester	1
Workload (hours)	162	Contact hours	T - TP - PL - TC - S - E - OT - O -
		Level	2-1
		ECTS credits	6.0
		Code	1076-809-1101-00-23

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) António Manuel Coelho Lino Peres, Maria da Conceição Constantino Fernandes

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Identify the different phases through microbial growth in batch operation conditions, in the presence of one or multiple substrates;
2. To understand the effects of dilution rate in continuous operation;
3. Determine productivities of batch and continuous cultures;
4. Identify operation conditions for different products produced by microorganisms;
5. Knowing different types of reactors;
6. Identify operation conditions in terms of ideal conditions;
7. Recognize potentials uses of microorganisms in bioremediation, biotransformation and biodegrading

Prerequisites

Before the course unit the learner is expected to be able to:

concepts of Microbiology, Transfer Phenomena and Chemical Reaction Engineering.

Course contents

Part I – Microbiology Topics; Parte II- Bioreactors.

Course contents (extended version)

1. Module I Microbiology Topics:
 - Growing, physical-chemical factors, nutritional requirements.
 - Exponential growth, time of duplication, n^o of generations
 - Microbiology of air, soil and water
 - Bioremediation, biodegradation, biotransformation: concepts and examples.
2. Module II Bioreactors:
 - Evolution of fermentation processes, flow diagrams, mode-operation bioreactors.
 - Material balance, kinetic of product, biomass formation and substrate consumption, yields
 - Monod equation
 - Operating modes: batch cultures, chemostat and "fed-batch"
 - Major types and comparison of biological reactors
 - Agitation and Aeration: Types of agitator, oxygen transfer
 - Scale-up
 - Residence time distribution: by-pass and dead-volume issues

Recommended reading

1. M. Nunes dos Santos, 1990, "Reactores Químicos", Fundação Calouste Gulbenkian;
2. Lima N, Mota M, 2003, "Biotecnologia- Fundamentos e Aplicações, Parte II- Biotecnologia Ambiental", Lidel;
3. Hurst CJ, Kmudsen GR, Mcherney MJ, Stetzenbach LD, Walter MV, 1997, "Manual of Environmental Microbiology", ASM Press. Washington;
4. Stanbury, P. F. and Whitaker, A. , 1984, "Principles of Fermentation Technology", Pergamon Press;
5. Bailey, J. E. and Ollis, D. F. , 1987, "Biochemical Engineering Fundamentals", McGraw;

Teaching and learning methods

Theoretical lessons - the professor will present the diverse subjects, using the expositive method and in diverse situations the demonstrative method; Practical lessons - resolution of exercises

Assessment methods

1. Intermediate written tests, - (Regular, Student Worker) (Final)
2. Final written exam. - (Regular, Student Worker) (Supplementary, Special)

Language of instruction

1. Portuguese
2. Spanish

Electronic validation

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16-01-2024	16-01-2024	22-01-2024	22-01-2024