UCL Université catholique de Louvain

LBIRC2108

2013-2014

Biochemical and Microbial Engineering

5.0 credits	30.0 h + 22.5 h	2q

Teacher(s) :	Agathos Spyridon ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	Icampus
Main themes :	From design to scale-up on a pilot scale of microbial and enzymatic processes. Theoretical and methodological foundations of applied chemical kinetics and design of chemical reactors with the characteristics (kinetics and transport phenomena) of biochemical and microbiological processes in order to systematize the principles underlying the analysis and design/sizing of bioreactors. Specifics: (Micro)biological processes characterized kinetically and thermodynamically : cell growth, its measurement or estimation, use of substrate(s), formation of product(s). Yields. Productivities. Kinetic models. Parameter estimation. The methodology of material and energy balances for the analysis of biotechnological systems and of their performance. Batch, continuous, semi- continuous reactors. Transport phenomena applied to the analysis of aeration, agitation, rheology, scale-up and sterilization of bioreactors.
Aims :	a. Contribution de l'activité au référentiel AA (AA du programme) 1.2 ; 2.1 ; 2.2 ; 2.4 ; 4.1 ; 4.2 ; 4.5 ; 8.5 b. Formulation spécifique pour cette activité des AA du programme At the end of this activity, the student is able to: 1. Apply the methodology of material balances to the analysis of biotechnological systems 2. Apply the methodology of energy balance to the analysis of biotechnological systems 3. Apply the methodology of reactor design to the analysis and design/sizing of bioreactors (area of biochemical and microbiological processes) in the specific case of batch reactors 4. Apply the methodology of reactor design to the analysis and design/sizing of bioreactors in the specific case of CSTR (continuous stirred tank reactor). 5. Apply the methodology of reactor design to the analysis and design/sizing of bioreactors in the specific case of semi-continuous reactors (fed-batch). 6. Apply mass transfer phenomena in the analysis of different operations (aeration, agitation, etc.) that can take place in bioreactors. 7. Apply the phenomena of energy transfer to the analysis of different operations (aeration, agitation, etc.) that can take place in bioreactors. 8. Apply the phenomena of transfer of momentum to the analysis of different operations (aeration, agitation, etc.) can take place in bioreactors. 9. Apply the methodology of chemical kinetics applied to the analysis and design/sizing of bioreactors (area of biochemical and microbiological processes). 10. Search for real values of constants "or of other parameters in correlations that are essential to the design/sizing of biological reactors. 11. As part of the design of a new biological reactor propose in a reasoned manner (with its advantages and limitations) the design of the most appropriate reactor with respect to the industrial context under consideration. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	Writtenexamination in 2 parts 1. Examination requiring short answers but based on a theoretical development 2. Examination focused on problem solving
Teaching methods :	1. Lectures, lectures with guided questions, including presentations of concrete examples from industry with case analysis by the instructor [conventional lectures, interactive presentations using audiovisual equipment (video projections, powerpoint)] 2. Exercise sessions in teams, guided. These exercises are designed to familiarize the student with the methodology of solving quantitative problems in the design and analysis of bioprocesses: makes use of calculations for sizing or performance, construction of flow sheets combining unit operations, search of real values of constants or other parameters of correlations useful in design or modeling / optimization of bioprocesses. The activity begins with a face-to-face presence only
Content :	Definitions: Definitions in bioengineering - quantities and reactors - microbial processes ' yields of biological processes in a reactor. Kinetic models of microbial growth. Modeling of a batch reactor - modeling of a continuous stirred biological system with and without recycling ' two-stage continuous stirred systems. Enzymatic process reactors - design and performance. Sterilization processes. Scale-up from laboratory scale through pilot scale to industrial scale. Bioseparations engineering. Ideal recovery process: primary

	separation, isolation, purification and polishing. Separation devices in industrial cell culture: continuous perfusion reactor with cell retention. Advantages and limitations of each design in an industrial context.
Bibliography :	- Mandatory supports(available on i-campus): Notes, slides, chapters and sections specified from the textbooks "Bioprocess Engineering Principles" by Pauline M. Doran 2nd edition (2013) and "Bioprocess Engineering" by Michael L. Shuler & mp; Fikret Kargi 2nd edition (2002) - Other supports: video projections, recommended reading: chapters and sections from the above textbooks
Cycle and year of study :	> Master [120] in Biochemistry and Molecular and Cell Biology > Master [120] in Chemistry and Bio-industries > Master [120] in Chemical and Materials Engineering > Master [120] in Biomedical Engineering
Faculty or entity in charge:	AGRO