

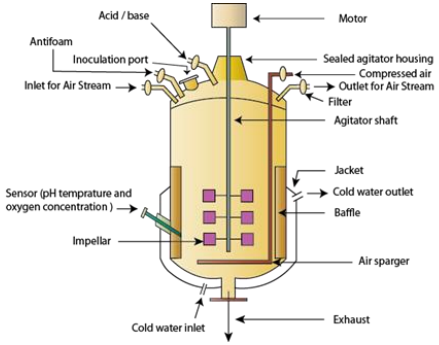


FERMENTATION TECHNOLOGY & ENVIRONMENTAL BIOTECHNOLOGY (LM3741)

1. Introduction

Design of a microorganism based bioprocess relies on knowledge on the microorganism to be grown, as well as bioreactor properties for creating an environment that allows the microorganisms to flourish. In this course both aspects of bioprocess design will be elaborated.

The first block of the course will focus on identification of the stoichiometry and kinetic properties of the wide range of microorganisms used in bioprocesses. Based on thermodynamic balances and some generalizations first estimates of the stoichiometric and kinetic process properties can be made.

During the second block of the course we will elaborate the considerations required for designing a bioreactor and a system of bioreactors for achieving the processing objectives.

2. Expected prior knowledge

The MCE course is obligatory for the *LST-Biochemical Engineering* Msc program. Prerequisite for participation in the course is a Bsc degree in *Life Science & Technology* (LST) or equivalent. Basic knowledge in Biochemistry, Molecular Biology, and Microbial Physiology is required. Some basic knowledge in Bioprocess Technology is desired.

3. Study goals

After the course, the students

- Can describe microbial metabolism in terms of chemical reaction stoichiometry and mass balances,
- Are capable of conducting a thermodynamic analysis of microbial metabolism;
- Can make a preliminary estimate of the kinetic properties of microbial metabolism, and compare the kinetic properties to literature data;
- Can make a first biochemical network analyses for constructing a product formation pathway required;
- Can make a basic bioreactor design for growing the microorganism of interest, including;
- Mixing properties and G/L mass transfer properties required, and;
- include simplified biofilm kinetics for designing a biofilm base process;
- Can elaborate a process scheme including various bioreactor units for achieving the conversions required;

4. Teaching Methods

The course consists of a number of lectures (see schedule for the different topics). In the first block the course focusses on the stoichiometric and kinetic properties of the microorganisms required, and the second block focusses on designing the bioprocess.

5. Case study

The case study to be elaborated eventually aims for the design of a process oriented towards a certain product (FT case) or a process for wastewater, solid waste, or off-gas treatment (EB case). Small groups (3 or 4) of students can choose the case study they want to elaborate from a list placed on blackboard. During both blocks, time is reserved for discussing the case study with the teachers. Groups will need to write a short technical report on the *microorganism* (block 1) and *process design* (block 2) aspects of their case study. Groups will need to present their case study in the end of the first and the second block as shown in the course schedule. Students working on an FT case will need to review a EB case and vice versa in a peer review system.

6. Assessment Methods

The information taught in the lectures will be assessed in an exam consisting of open questions. The case study is evaluated by the instructors and the peer review system described above. The final mark of the course is the mean of the marks for the exam (50%) and the case study (50%). The minimum score for the exam is 5.0.

8. Information

For more information on the course, please contact Robbert Kleerebezem (r.kleerebezem@tudelft.nl, 0152781091) or Walter van Gulik (w.m.vangulik@tudelft.nl, 0152784629).

FERMENTATION TECHNOLOGY & ENVIRONMENTAL BIOTECHNOLOGY

LM3741-2016
Teachers: Robbert Kleerebezem, Walter van Gulik, Gerben Stouten, Cristian Picioreanu, and Henk Noorman

Course schedule:

Period	Date	Time		Location	Title	Teacher
		From	To			
1	8-9-2016	08:45	10:30	A2.050	Introduction	Robbert
	15-9-2016	08:45	10:30	A2.050	Stoichiometry	Robbert
	22-9-2016	08:45	10:30	A2.050	Thermodynamics	Robbert
	29-9-2016	08:45	10:30	A2.050	Basic kinetics	Robbert
	30-9-2016	10:45	12:30	A1.150	Case study discussion	Robbert/Walter/Gerben
	6-10-2016	08:45	10:30	A2.050	The process reaction / Thermodynamics	Walter
	13-10-2016	08:45	10:30	A2.050	The fermentor / Process modes	Walter
	20-10-2016	08:45	10:30	A2.050	Case study discussion	Robbert/Walter/Gerben
	27-10-2016	08:45	10:30	A2.050	Determining parameters from experimental data	Robbert
	28-10-2016	10:45	12:30	A1.150	Case Study presentation 1	Robbert/Walter/Gerben
2	15-11-2016	13:45	15:30	B2.160	Basic treatment schemes	Robbert
	16-11-2016	08:45	10:30	B2.160	Basic G/L masss transfer in bioreactors	Henk
	22-11-2016	13:45	15:30	A2.050	Basic biofilm bioreactor design	Cristian
	23-11-2016	08:45	10:30	A1.150	Basic fermentation process design	Walter
	29-11-2016	13:45	15:30	B2.160	Case study discussion	Robbert/Walter/Gerben
	30-11-2016	08:45	10:30	A1.150	Heat transfer in bioreactors	Henk
	30-11-2016	10:45	12:30	A1.150	Mixing in bioreactors	Henk
	6-12-2016	13:45	15:30	A2.050	Biofilm flux analysis and process design	Cristian
	7-12-2016	08:45	10:30	A1.150	Activated sludge process for C, N, and P removal	Robbert
	13-12-2016	13:45	15:30	A2.050	Case study discussion	Robbert/Walter/Gerben
	14-12-2016	08:45	10:30	A1.150	Cost modelling / Measurements why and how	Walter
	20-12-2016	13:45	15:30	A2.050	Anaerobic digestion of biomass	Robbert
	21-12-2016	08:45	10:30	A1.150	Case Study presentation 2	Robbert/Walter
	21-12-2016	10:45	12:30	A1.150	Exam preparation	Robbert/Walter