

CHEM-E3130 Biolab II Introduction lecture

Autumn 2020



Teachers in the course

- Responsible teacher
 - Tero Eerikäinen
- Methods lecture
 - Tero Eerikäinen
- Laboratory work teachers
 - Vijaya Chandgude (Laboratory work 1 (xylanase work))
 - Henni Tuomala (Laboratory work 1 (xylanase work))
 - Hannamari Haikonen (Laboratory work 1 (xylanase work))
 - Tero Eerikäinen (Laboratory work 2 (mannitol scale-up work))
 - Tuukka Levä(Laboratory work 2 (mannitol scale-up work))



Course objectives

- Further develop biotechnology laboratory working skills
- Deepening previously learned theory
- Learning the equipment and methods needed to perform fermentations and downstream processing
- Learn to:
 - Organized teamwork
 - Eschericia coli recombinant protein production in a bioreactor
 - Protein purification steps
 - Leuconostoc mesenteroides mannitol production in pilot scale
 - Efficient bioprocess downstream methods
 - Comparison of own results with results from literature
 - Reporting results as written reports and seminar presentation



Course content

- Entry exam
- Two separate laboratory works
 - Each work last a week
- Laboratory work 1
 - Lab scale fermentation with recombinant *E. coli*, protein purification and different protein analyses
- Laboratory work 2
 - Pilot scale fermentation with lactic acid bacteria *L. mesenteroides* and subsequent downstream processes
- Seminar presentation
- Work reports to be done in groups



Laboratory work 1

- Done in groups of 3-6 students
- Duration one week
 - Longest day is main cultivation day
- Biotechnological production of recombinant protein in lab scale
- Protein purification
 - Ammonium sulfate precipitation
 - Immobilized Metal-ion Affinity Chromatography (IMAC)
- Biochemical analysis of protein
 - SDS-PAGE (molecular weight and purity)
 - Protein assay
 - Enzyme activity assay





Laboratory work 2

- Scale-up of a bioprocess
 - Work groups of 3-6 students
 - Instructions can be found also in (read pages 9-16; 21-27; 39-45; 54-61; 80-84 and 97-99):
 http://lib.tkk.fi/Diss/2002/isbn9512258854/isbn9512258854.pdf
- Duration one week
- Biotechnical production of sugar alcohol in pilot scale using *L. mesenteroides*
- Scale-up from cell bank to pilot bioreactor
- Final production in 200 L reactor
- Downstream processes
 - Cell separation, product concentration, crystallization and separation of crystals





Timetable for groups G1-G2



Timetable for	Biolab II: autumn II	period 2020			
	Monday	Tuesday	Wednesday	Thursday	Friday
Week 44 2630.10.		Intro and methods lectures 10-11:30 Zoom			
Week 45 26.11.					Finish lab entry exam
Week 46 913.11.	Bioreactor cult. 2L G1 Scale-up preparation G2	Bioreactor cult. 2L G1 Biostat Cplus 10L G2	Protein purif. G1 Marubishi 200 L G2	SDS-PAGE G1 Evaporation G2	Enz.activity G1 Crystallization G2
Week 47 1620.11.	Bioreactor cult. 2L G2 Scale-up preparation	Bioreactor cult. 2L G2 Biostat Cplus 10L	Protein purif. G2 Marubishi 200 L	SDS-PAGE G2 Evaporation	Enz.activity G2 Crystallization
Week 48 2327.11.					
Week 49 30.114.12.			G1 xyl report DL G2 mann report DL		
Week 50 711.12.			G2 xyl report DL G1 mann report DL	Final seminar in Zoom 14:15-15:45	
Week 51 1418.12.	EXAM WEEK		1		I

Laboratory notebook



- Done in electronic form with both groups
 - Shared the workload for the filling electronic notebook from handwritten notebooks
 - Sign your part of the laboratory notebook
- The assistant gives the personal notebooks
- All the lab work should be documented
 - All of the results and observations
 - Also unsuccesful/failed steps
- Lab notebook gives the possibility to trace back the workflow, important phases and possible mistakes



Reports of lab works

- Done in groups, but you can share the work by giving "own" response chapter/part,
- More details in course instructions document
- A good idea is to write the introduction already before the work
- No direct copying from the lab instructions, try to find some new references to intro part
- Put the objectives clearly to the report
- When reading the report, one should be able to repeat the main steps of your work
- Show/sign the part/chapter you have written and discuss it with your group members
- The grading is formed partly from group's and partly from personal efforts



Seminar presentation

Presentations on Thu 10.12. at 14:15-15:45 in Zoom

- Groups 1a and 2a present own xylanase work, group 2b and 1b prepare questions
- Groups 1b and 2b present own scale-up work, group 2a and 1a prepare questions
- Groups prepare for discussing for example
 - Results from the *E. coli* lab work
 - Cell growth and density
 - Recombinant protein expression yield (purification table)
 - SDS-PAGE analysis
 - Xylanase activity
 - Results from the scale-up work
 - Different cultivation scales
 - Down-stream processes
 - Yield in different phases



Practical things

- Neighbor groups (1a and 1b and 2a and 2b) carry out same work in shifts, sometimes together, sometimes alone
- Read the laboratory instructions well
- Calculate some things, like dilutions, in advance
- Lab works done in groups
 - keep up with your group, help each other, but keep distance
- Each subgroup
 - Has one online notebook
 - Writes reports from both works



Course load

- Introduction lecture + methods lecture (2 h)
- Exam with preparing for laboratory work (1+10 h)
- Laboratory work (60 h)
- Report for lab work 1 (25 h)
- Report for lab work 2 (25 h)
- Preparing seminar presentation (10 h)
- Seminar (2 h)
- All together 135 h = 5 op





Grading

- Grade 1 5
- Max 100 points distributed as follows:
 - Entry exam 15
 - Activity and attendance in the laboratory 30
 - Laboratory notebook 10
 - Reports 40
 - Seminar presentation 5





Needed for the approved course

- Entry exam
- Attendance in laboratory
- Approved final report s
- Completed lab notebook
- Seminar presentation
- Course feedback





The work groups

Group 1a	
Granqvist	Alexandra Helena
Heikkilä	Maria Elina
Kotovuori	Tomi Arttu Oskari

Group 1b	
Jäämuru	Ilta Vilma Valpuri
Kutvonen	Kim Samuel
Kääriäinen	Katri Mari Annikki

Group 2a	
Moisanen	Henri Gabriel
Pajumo	Maria Patricia
Ristimella	Saimi Olga Inkeri

Group 2b	
Turunen	Isa Rosaliina
Wallin	Mirjami Henriikka
Xia	Xin



10/27/2020