

CHEM-E3130

Biolab II

Introduction lecture

Autumn 2021



Teachers in the course

- Responsible teacher
 - Tero Eerikäinen
- Methods lecture
 - Tero Eerikäinen
- Laboratory work teachers
 - Xylanase work:
 - Ville Aumala
 - Taru Koitto
 - Deepika Dahiya
 - Mannitol scale-up work:
 - Tero Eerikäinen
 - Goyal Pankaj
 - Öztürk Abdullah

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
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Course content

- Entry exam, calculation quiz
- 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 (xylanase work)

- Done in groups of 6-7 students (two groups per week)
- 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 work)

- Scale-up of a bioprocess
 - Work groups of 6-7 students (two groups per week)
 - 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

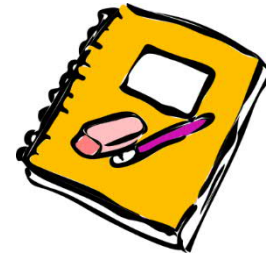


Timetable for groups G1-G4



Timetable for Biolab II: autumn II period 2021					
	Monday	Tuesday	Wednesday	Thursday	Friday
Week 44 1.-5.11.	Scale-up preparation G1&G2	Biostat Cplus 10L G1&G2	Marubishi 200 L G1&G2	Evaporation G1&G2	Crystallization G1&G2
Week 45 8.-12.11.	Bioreactor cult. 2L G3&G4	Bioreactor cult. 2L G3&G4	Protein purif. G3&G4	SDS-PAGE G3&G4	Enz.activity G3&G4 G1&G2 man report DL
Week 46 15.-19.11.	Bioreactor cult. 2L G1&G2	Bioreactor cult. 2L G1&G2	Protein purif. G1&G2	SDS-PAGE G1&G2	Enz.activity G1&G2 G3&G4 xyl report DL
Week 47 22.-26.11.	Scale-up preparation G3&G4	Biostat Cplus 10L G3&G4	Marubishi 200 L G3&G4	Evaporation G3&G4	Crystallization G3&G4 G1&G2 xyl report DL
Week 48 29.11.-3.12.					G3&G4 man report DL
Week 49 6.-10.12.				Final seminar 14:15-15:45	
Week 50 13.-17.12.	EXAM WEEK 1				
Week 51 20.-23.12.	EXAM WEEK 2				

Laboratory notebook



- Done in electronic form with both groups
 - Shared workload by filling the 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 unsuccessful/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 or live

- Groups 1 and 3 present xylanase work results, groups 4 and 2 prepare questions as opponent
- Groups 2 and 4 present scale-up work results, group 3 and 1 prepare opponent 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 (1 and 2; 3 and 4) 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 group
 - Has one online notebook
 - Writes reports from both works

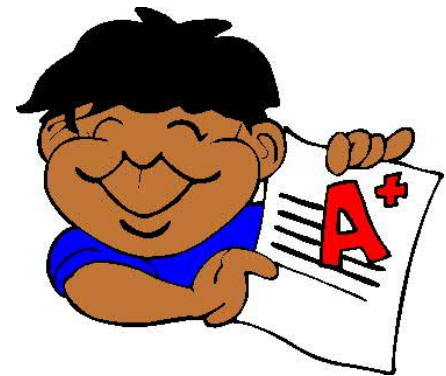
Course load

- Introduction lecture + methods lecture (2 h)
- Exams with preparing for laboratory work (16 h)
- Laboratory work (60 h)
- Report for lab work 1 (25 h)
- Report for lab work 2 (20 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:
 - Exam and quiz 20
 - Activity and attendance in the laboratory 30
 - Laboratory notebook 10
 - Reports 30
 - Seminar presentation 10



Needed for the approved course

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

A red rectangular stamp with a distressed, ink-like texture. The word "APPROVED" is written in bold, uppercase letters inside the stamp, which is tilted slightly to the right.

The work groups

Group 1	
al-Itawa	Muhemmed Bagir
Gil González	Alexia
Haikarainen	Ronja Unelma
Hämäläinen	Petteri Samuel
Heikkilä	Maria Elina
Huusela	Vilma Martina

Group 3	
Leppänen	Heidi Roosa Juulia
Linna	Artturi Alexander
Lohilahti	Olli Antero
Möttönen	Nea Beata
Oksa	Katri Maria
Penttinen	Hanna-Reetta Maria

Group 2	
Kääriäinen	Katri Mari Annikki
Kangas	Laura Karoliina
Kivekäs	Linnea Paula Tuulikki
Korkiakoski	Mikko Eerik
Lainio	Eveliina Roosa Maria
Lamminjoki	Leevi Tapio
Leppäkangas	Emilia Anna Talvikki

Group 4	
Raiskio	Elisa Kaarina
Rantanen	Rasmus Santeri
Rekinen	Saana Katariina
Seppänen	Sami Petteri
Soininen	Wille Ilmari
Tynkkynen	Milla Lotta Henriikka
Virta	Nea Karolina