BB2070 Biochemical Technology 10.5 credits

Bioprocessteknik

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for BB2070 valid from Autumn 2007

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Biotechnology

Specific prerequisites

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After passing the course, the student should be able to:

- describe different common production organisms and compare their properties in order to receive certain products
- describe the main features of **E.coli**, yeast and animal cells' growth, substrate intake and primary metabolism
- describe normally used media (including provided substrates such as pH-regulation components, nourishment supply) in bioprocesses, explain the cause of their structure and motivate why different choices (quantity, type) influence the process results.
- apply mathematical simulations and kinetic concepts for calculation of cell growth, nourishment turnover, byproducts and product culture in processes based on batch, continual and fed-batch techniques including recirculation systems.
- explain how byproduct culture (especially overflow metabolism) can be controlled in bioprocesses.
- describe bioreactors' structure and what equipment is used
- describe which parameters are usually measured and regulated in the bioreactor and which principles are used. Be able to speculate about how variables are changed with time in a given bioprocess.
- describe how mass transport of gas happens in a bioreactor and know how the efficiency in oxygen transference and blending is measured (measurement and mixing time). Explain how the different values can affect the bioprocess.
- describe how the relationship between force and tension changes the viscosity in different bioprocesses and explain how this can be controlled based on conventional bio-process parameters
- describe principles of scaling up bio-processes and suggest different methods for given processes
- describe how the product quality can be controlled in several given process examples (protein, baker's yeast).
- recognize several common unit operations in purification processes and which parameters can be used to control exchange and purity
- suggest purification methods on the basis of cells and process character
- cultivate micro organisms in bioreactors controlled by traditional process regulation methods and purify a chosen product from that system

Course contents

The history of bioprocess development and today's practical applications. Pro- and eukaryote cell technology and metabolism with emphasis on industrially used production systems. Enzyme technology. Design and sterilisation of bioreactors. Oxygen transfer. Cultivation techniques: batch, fed batch and continuous cultivation. Kinetics and calculation of productivity and yield including practical exercises. Theology and scale-up. Protein purification: principles, small and large scale techniques. Industrial processing: recombinant protein production, large scale enzyme and antibiotics production and waste water treatment. Simulation exercises: from a model of a commercial process based on the unit operations for cultivation and purification of protein.

Laboratory exercise: Cultivation of cells of Escherichia coli producing the enzyme ß-galactosidase in 1 m3 scale and purification of this enzyme. The following unit operations are part of the purification: cell harvest through centrifugation, high pressure homogenisation, two-phase extraction, phase separation through centrifugation and ultra filtration.

Course literature

S.-O. Enfors and L. Häggström: Bioprocess technology - Fundamentals and applications, KTH 2001.
Veide et al.: Produktion av β-galaktosidas (lab compendium).

Examination

- TEN1 - Examination, 7.5 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 3.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

Hand-in assignments, lab reports (LAB1; 4.5 credits, grading scale Pass/Fail), a written exam (TEN1; 6 credits, grading scale A-F).

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.