Metabolic Engineering – online study materials

Motivation of the course:

Students coming from other universities are often unfamiliar with Delft-style Bachelor's courses like *Metabolic Engineering and Biotechnology 1* that combine biochemistry with engineering approaches, in particular the balancing aspects. A range of online material is available to enable these students to follow the mandatory MSc-courses *Analysis of Metabolic Networks* and *Bioprocess Integration* (that rely heavily on engineering approaches to analyze and design processes). We expect prospective students to make good use of this online course material.

Content of the course and substitution by online material:

- Nutrients for microbial growth (C, N, O, P)
- Aerobic and anaerobic growth
- Stoichiometry of metabolic pathways, key-metabolites, co-factors (NAHD, ATP), product reaction (balancing chemical reactions)
- Growth reaction (derive from ATP & cofactor requirements or yield)
- Diversity in microbial metabolism (glycolysis, TCA, overflow metabolism, ETC)
- Batch, fed-batch, chemostat
- Balancing of bioreactor systems – biomass specific, volumetric, bioreactor-based rates
- Setting up the substrate relation using Herbert-Pirt

The level of the content is basic BSc and can be covered using online material available from different sources:

- ***Balancing of (single) chemical reactions***:

  https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome/balancing-chemical-equations/v/visually-understanding-balancing-chemical-equations

- ***Balancing of bioreactor systems and process reaction, q-rates, Black-box approach***

  edX course: DelftX: IB01x, Industrial Biotechnology lectures:

  (please mail to info-lst@tudelft.nl first, to enable full access to the course at any moment)

  2.1 Microorganisms and their function in nature
  2.2 Functional understanding of nutrient requirements for microbial growth
  2.3 Learning about the process: Broth balances
  2.4 Learning about the process: Gas phase balances
  2.5 Learning about the microorganism: q-rates and chemostat
  2.6 Learning about the process and organism: Batch
  Optional: 2.7: Extra guest lecture balances
  3.1 The process reaction
  3.2 Basics of the black box model
  3.3 Energy consuming and energy producing products

- ***Self-assessment via edX:***

  PDO case Q1: Production rates
  PDO case Q2: O2 and CO2 transfer (Tn,o & Tn,c)
  PDO case Q3: Ro and Rc calculation
  PDO case Q4: Data check
  PDO case Q5: q-rates
  Questions for Unit 3.3