Designing mixed-culture bioprocesses by means of bioenergetics models

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BIOCHEM project: Designing mixed-culture processes for a circular economy

Mixed culture processes

Pros

Cons

- No sterilisation
- Complex and not fully understood
- Treat complex substrates
- Very variable outcome
- Robust
- Novel bioprocesses are hard to design

The design of a bioprocess that uses a mixed culture is a hard task. BIOCHEM tackles this issue with a special focus on the use of modelling tools.

USC: Selecting the operating conditions

Case study: to produce butyrate from a glucose-rich waste (4 g/L)

Select the HRT with the kinetic model

Select the microbial population

1. Determine the stoichiometry and select the pH with the bioenergetics model

2. Two regions of interest arise from the simulation results:

   - Maximum productivity. Interesting for very high added-value products
   - Maximum yield. Appropriate for bulk chemicals and difficult-to-separate products (butyrate).

Results from the model suggest to select a pH ≤ 5.5 to ensure a high butyrate stoichiometric coefficient.

Future perspectives in BIOCHEM

- Including protein and lipids in our models for assessing complex substrates.
- To incorporate separation processes (e.g. in situ Product Recovery) in our modelling framework in collaboration with TUHH.
- The expected end result is a virtual plant for early stage simulation of mixed culture fermentations.

References


Acknowledgements

This activity is supported by ERA-I-2 project BIOCHEM (PCIN-2016-102), funded by MINECO, and by the Spanish Ministry of Education through the FPU scholarships (FPU14/05457).