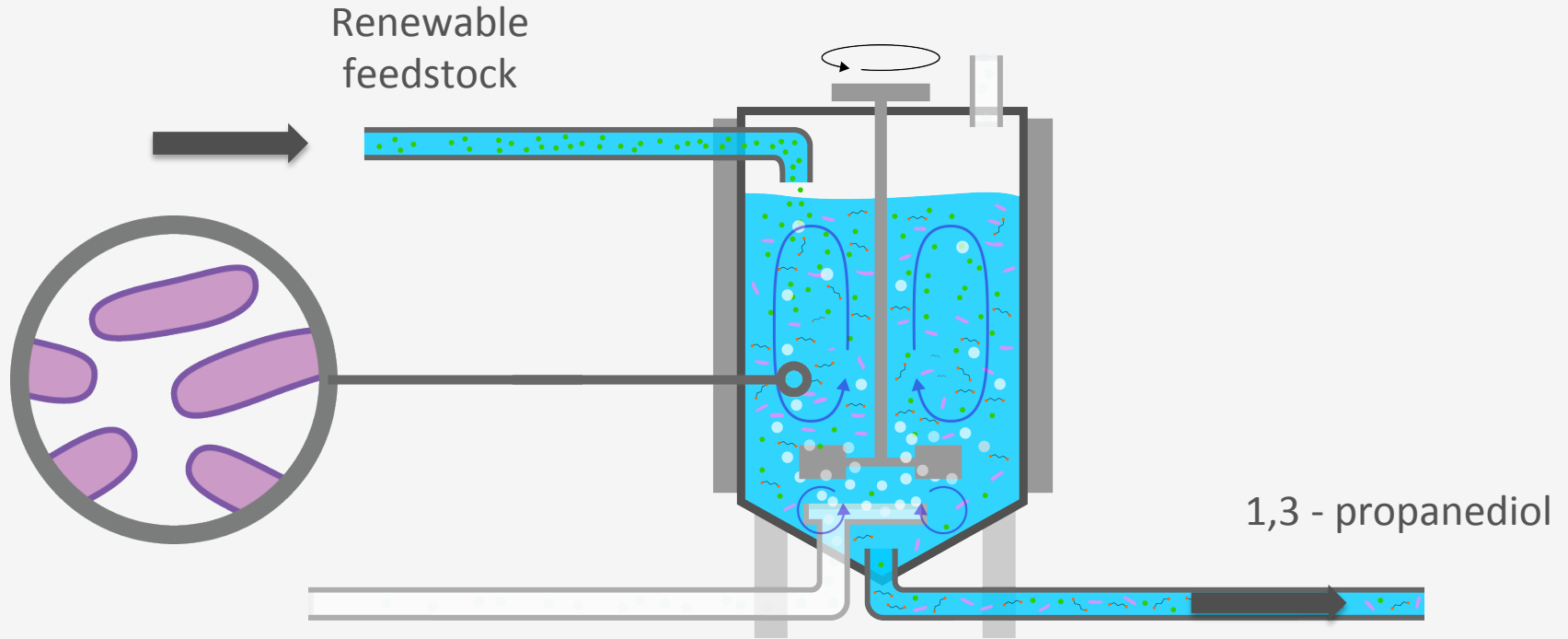
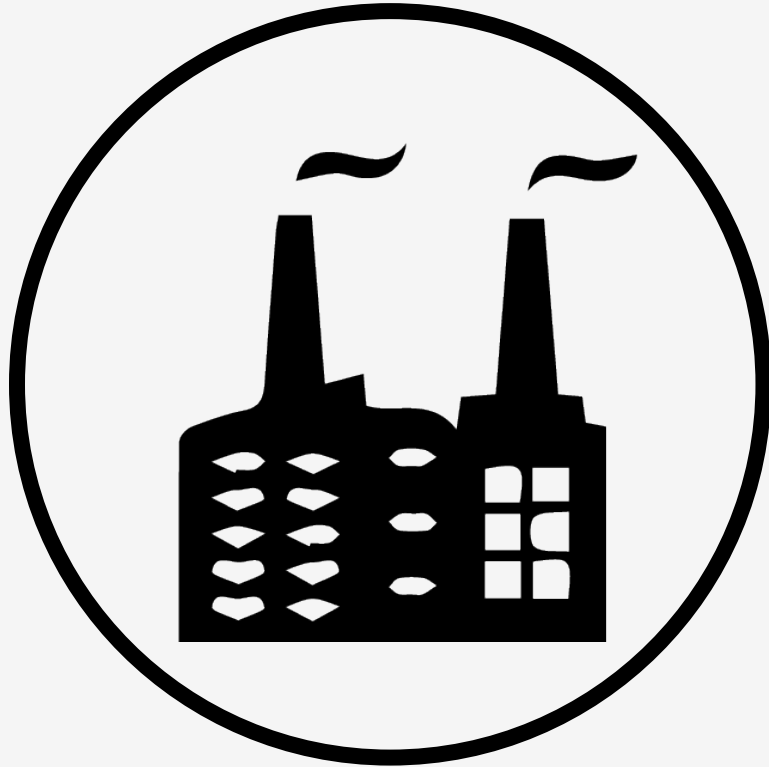


Introduction to fermentation technology

Henk Noorman, DSM / Department of Biotechnology, Faculty of Applied Sciences

The process reaction in the factory

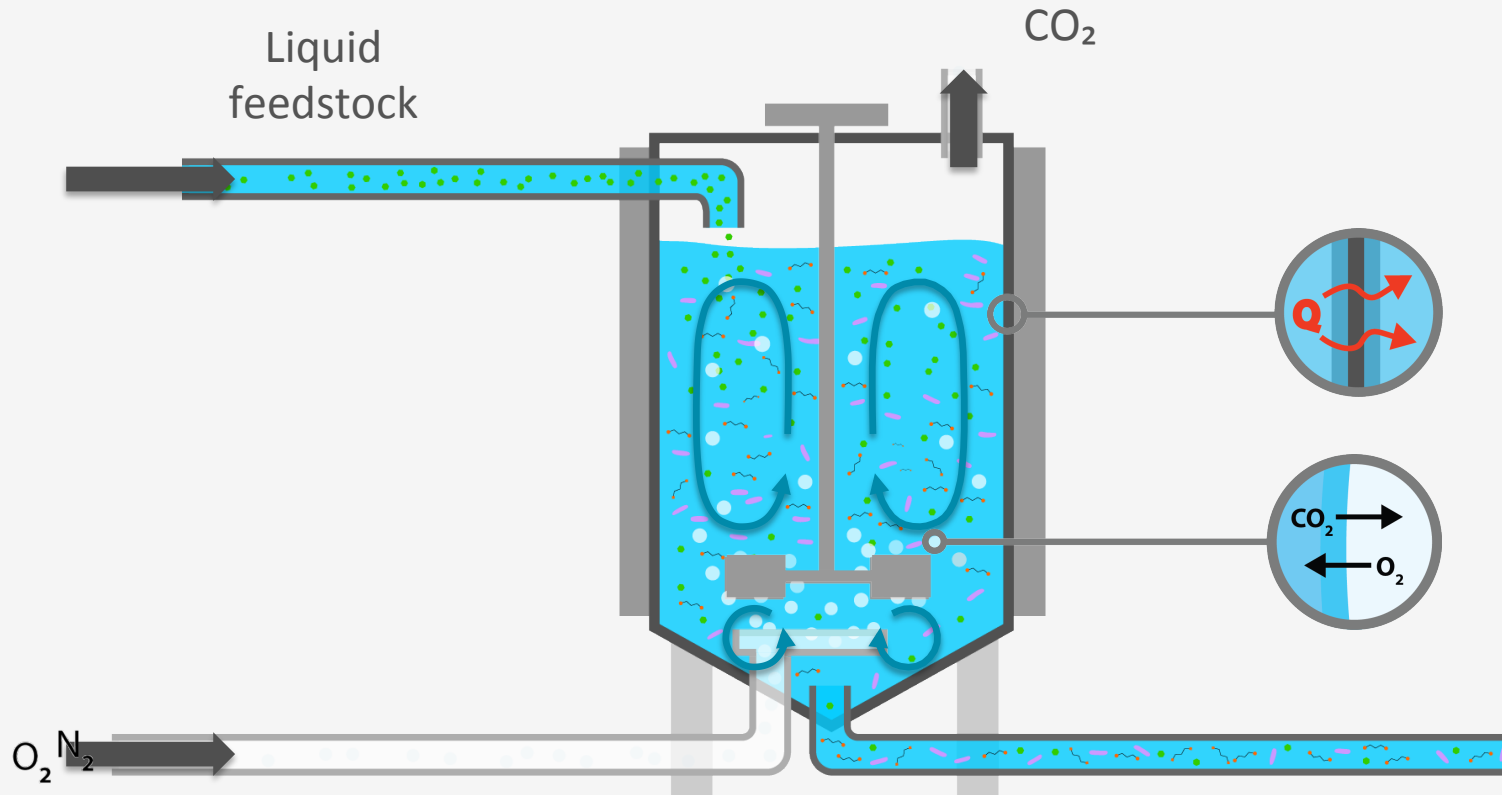




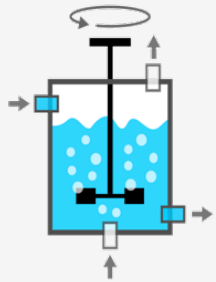
Transport limitations



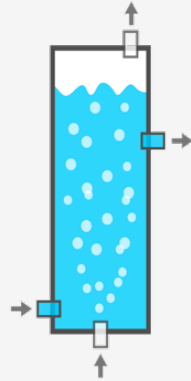
Bottlenecks in transport phenomena



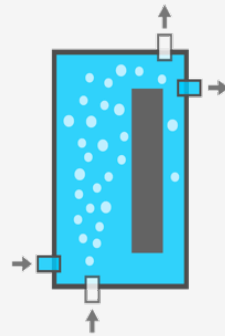
Reactor types



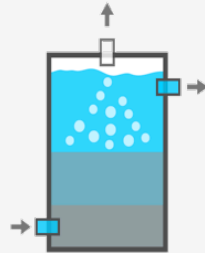
**Stirred
tank
reactor**



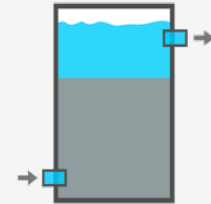
**Bubble
column**



**Airlift loop
reactor**



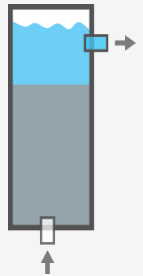
**Upflow
anaerobic
sludge
blanket**



**Single
stage fluid
bed**



**Multi
stage
fluid bed**

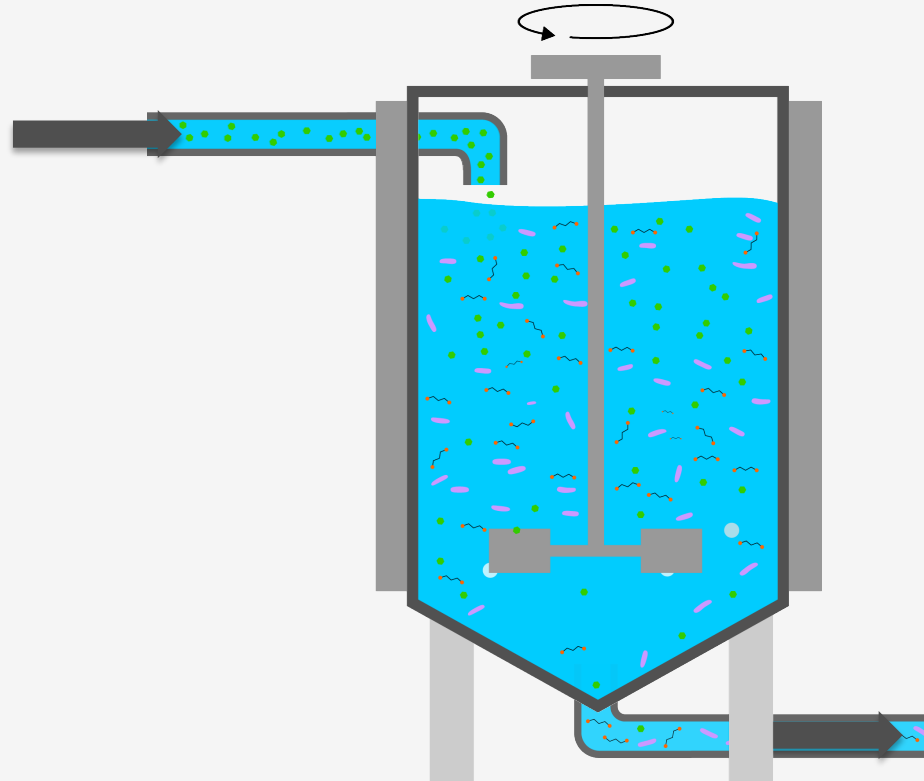


**Packed
bed
column**

Fermenter operation

Different modes

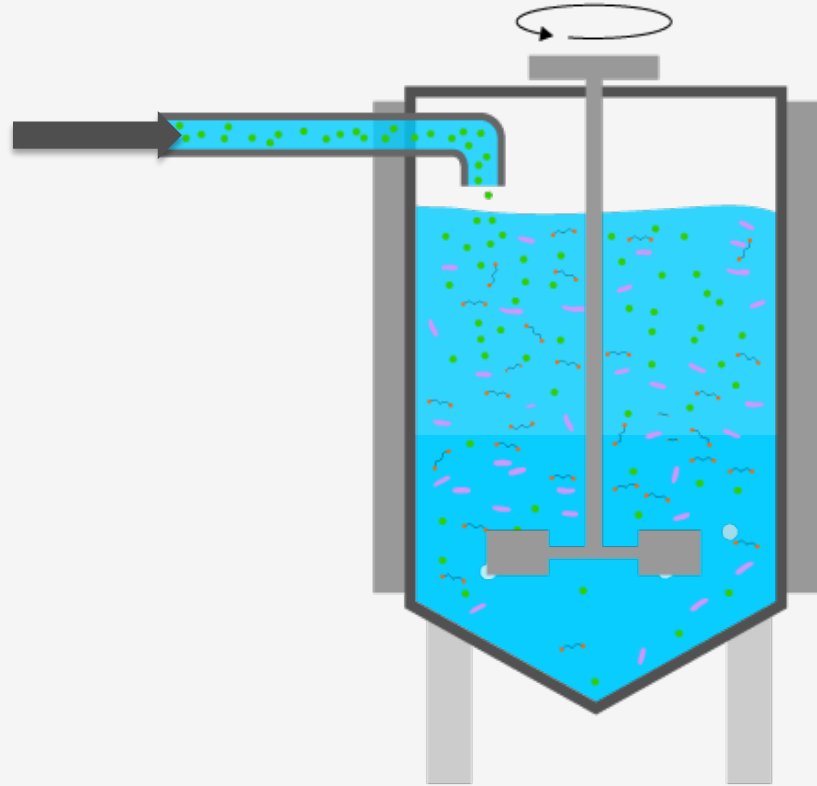
- Batch
- Continuous



Fermenter operation

Different modes

- Batch
- Continuous
- Fed-batch



Design aspects

Transport issues

Bioreactor type

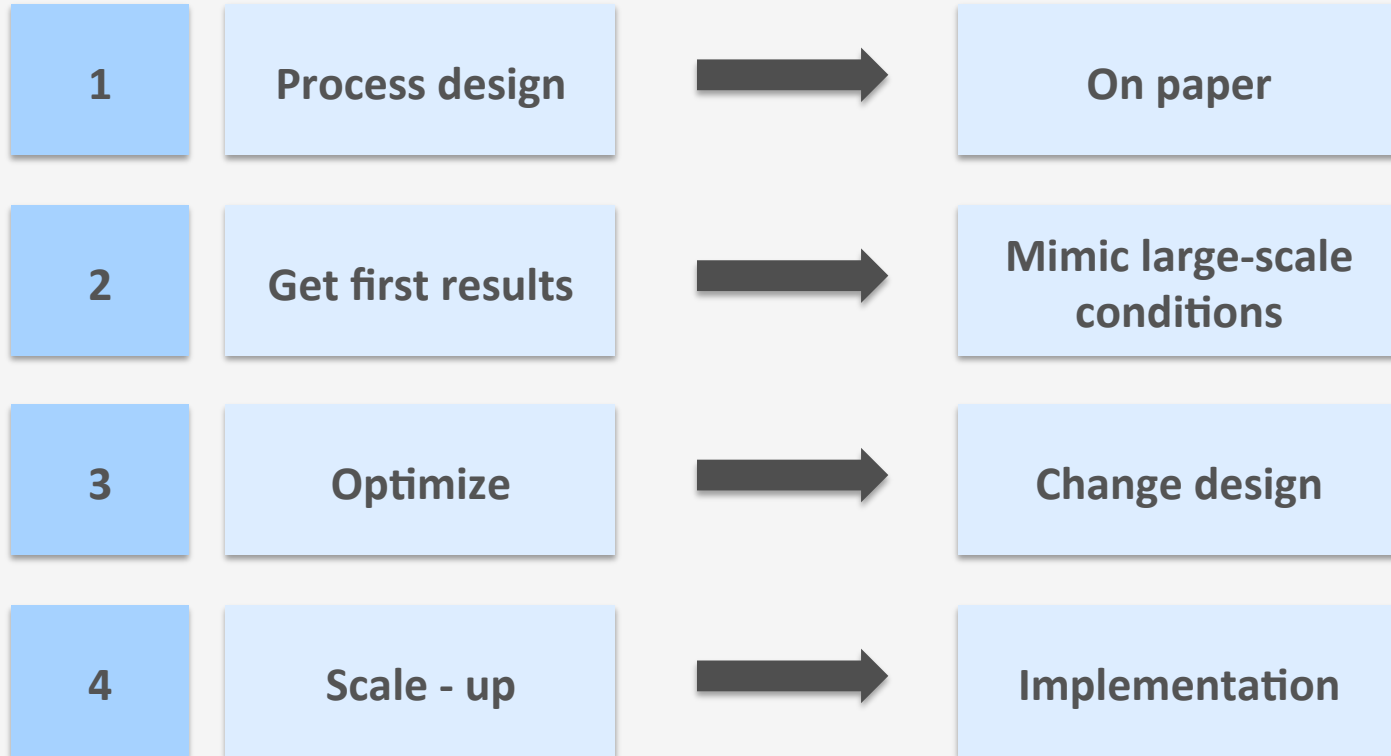
Bioreactor operation

Properties of the microorganism

Feedstock

Product toxicity

Design procedure



See you in the next unit!