



Gas analysis of the future



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Optimisation of bioprocesses

With a controlled process optimisation
and a process control



Structure

1. Introduction
2. Gas analysis for biotechnology
3. Used sensor techniques
4. Gas analysis for scale-up
5. Summary

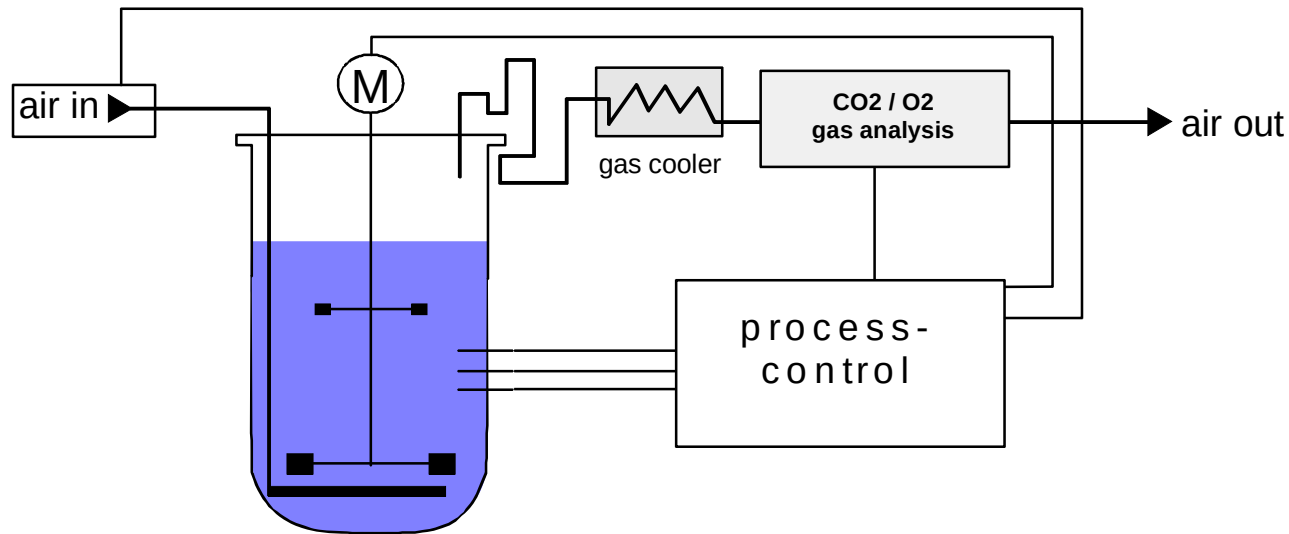


Gas analysis for Biotechnology

- off gas analysis during fermentations: CO_2 , O_2 , ...
- Headspace in shake flasks: CO_2 , O_2 , MeOH, EtOH...
- Packages: inert gas, CO_2
- Biogas plants: methane, CO_2 , H_2S ...

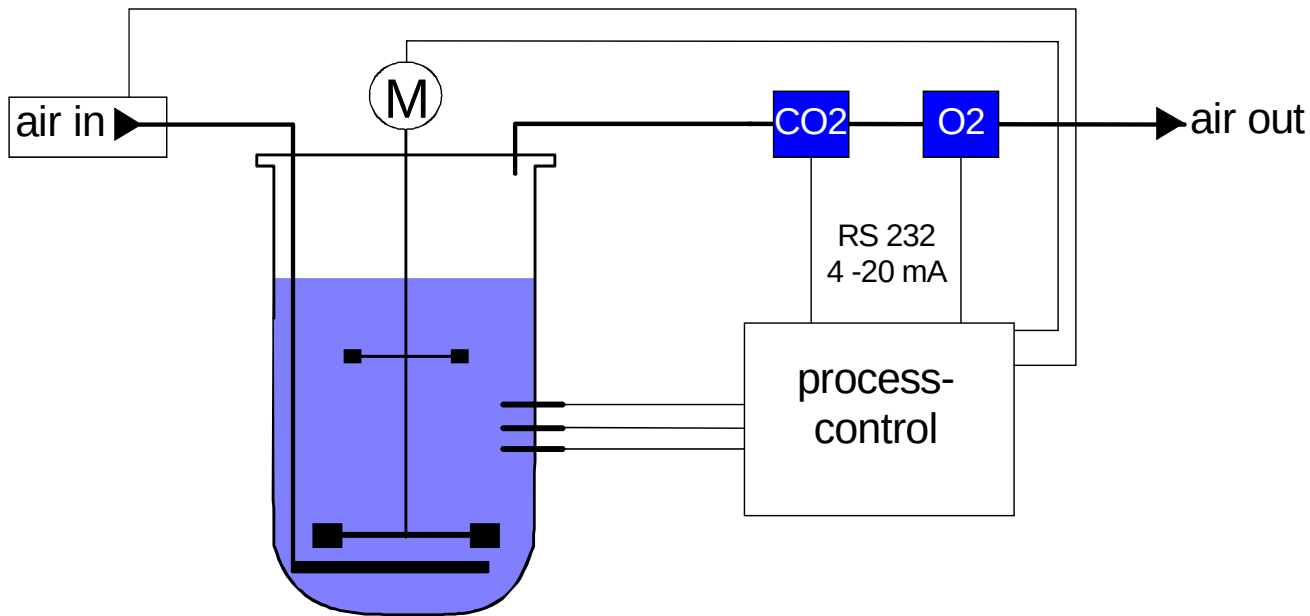


“normal” gas analysis



Transport from the gas to the analyzer!

“modern” gas analysis (PAT)



Measuring where something happens!

BlueSens



for small pipes...



...for large pipes...



...or for tubes

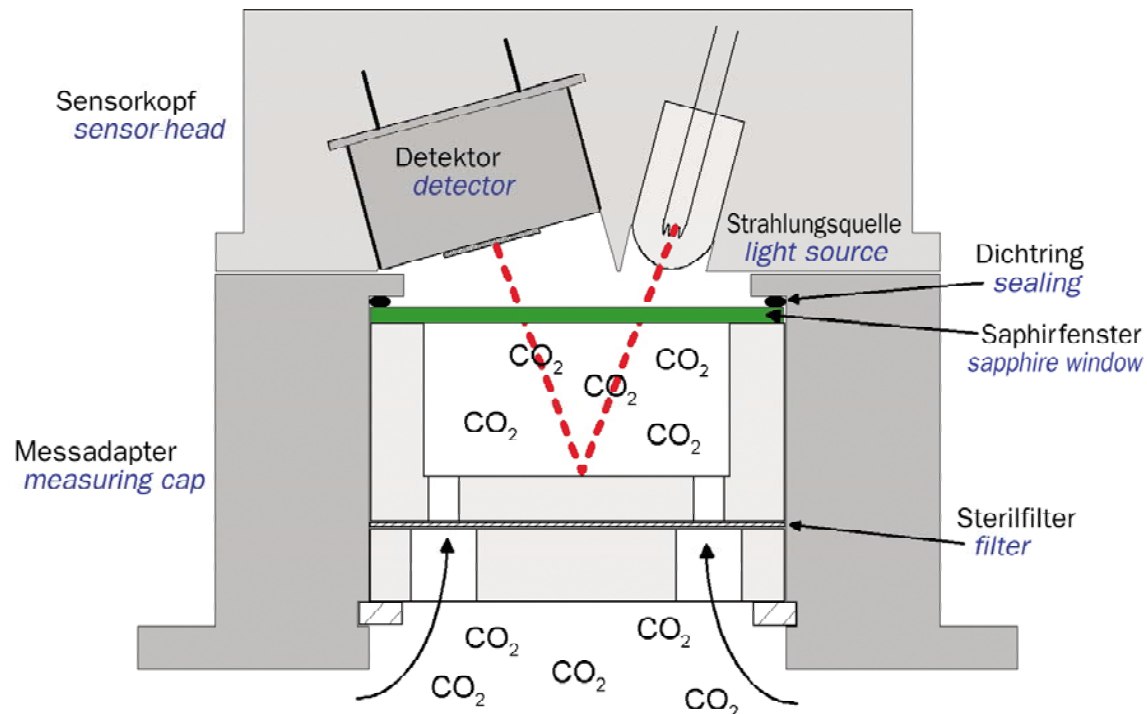


BC
proFerm

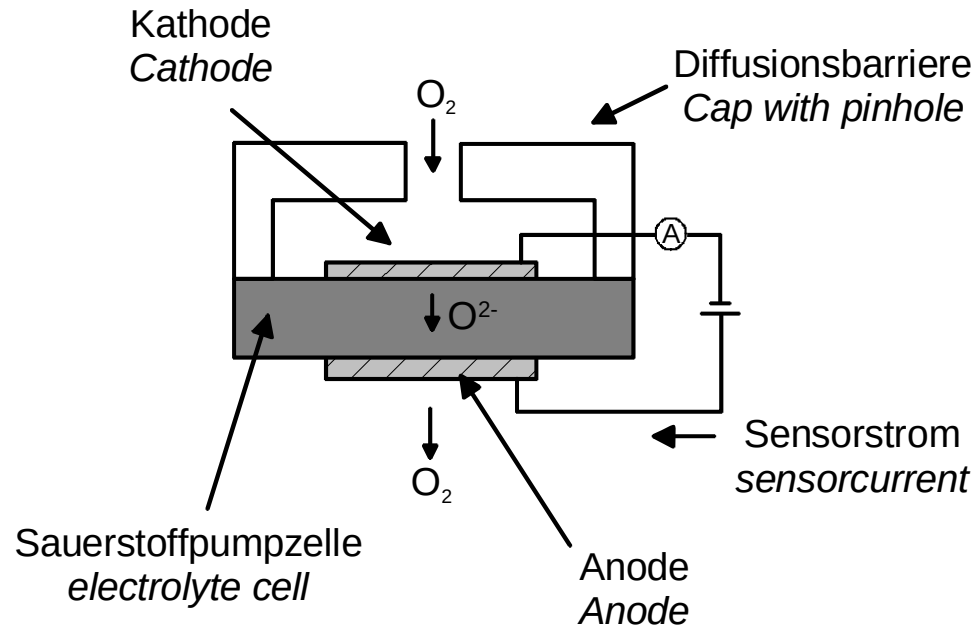
The size doesn't matter!

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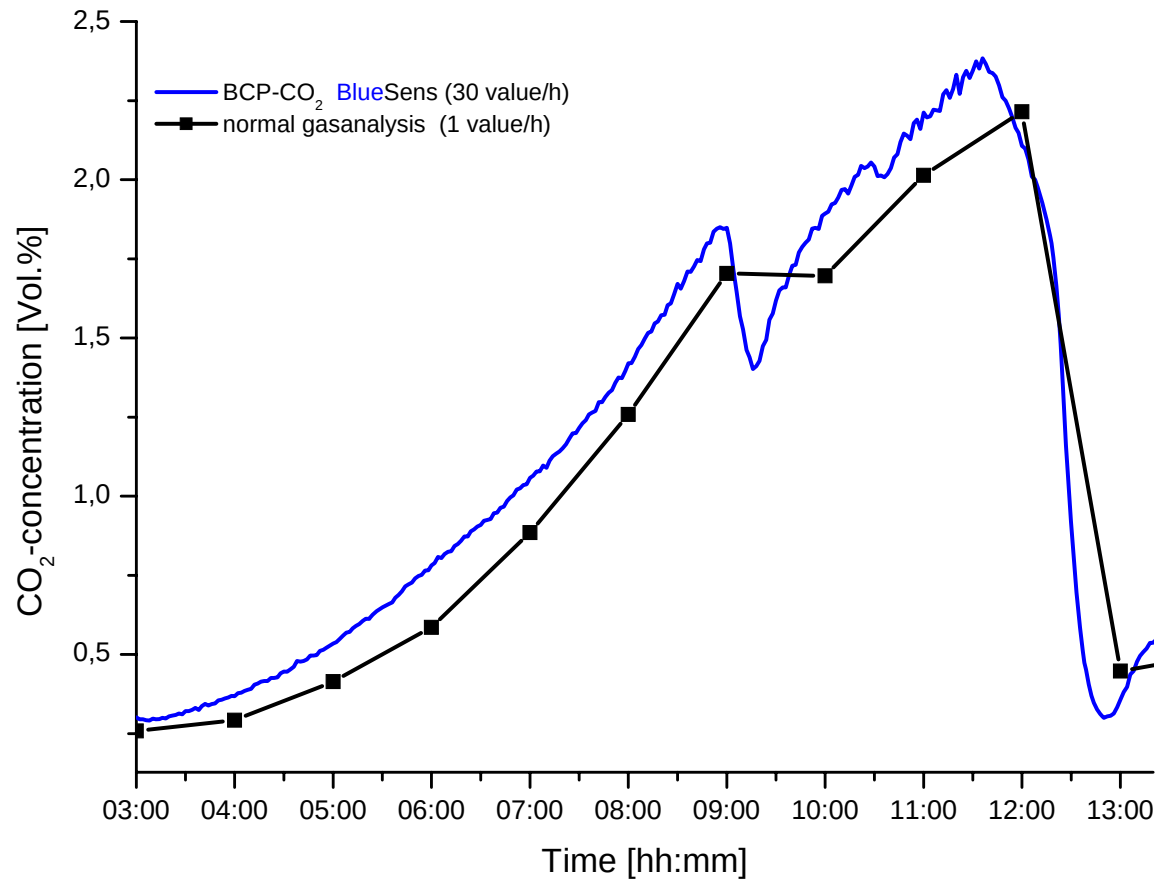
BACCap[®] - Technology

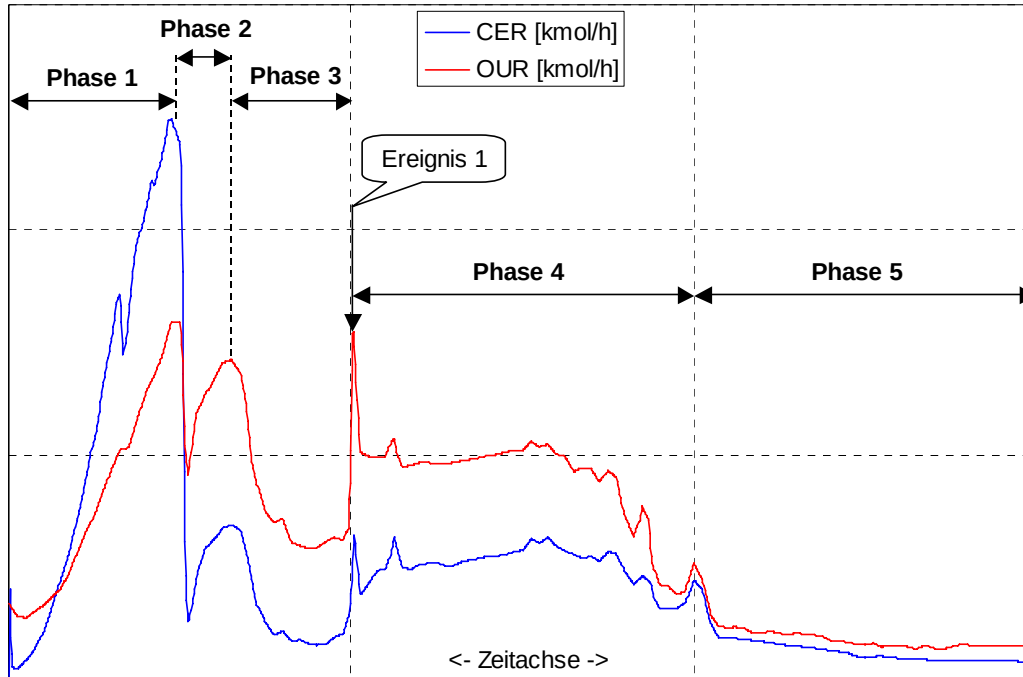


ZrO₂-Technology



Online CO₂-measurement in an exhaust pipe of a fermenter

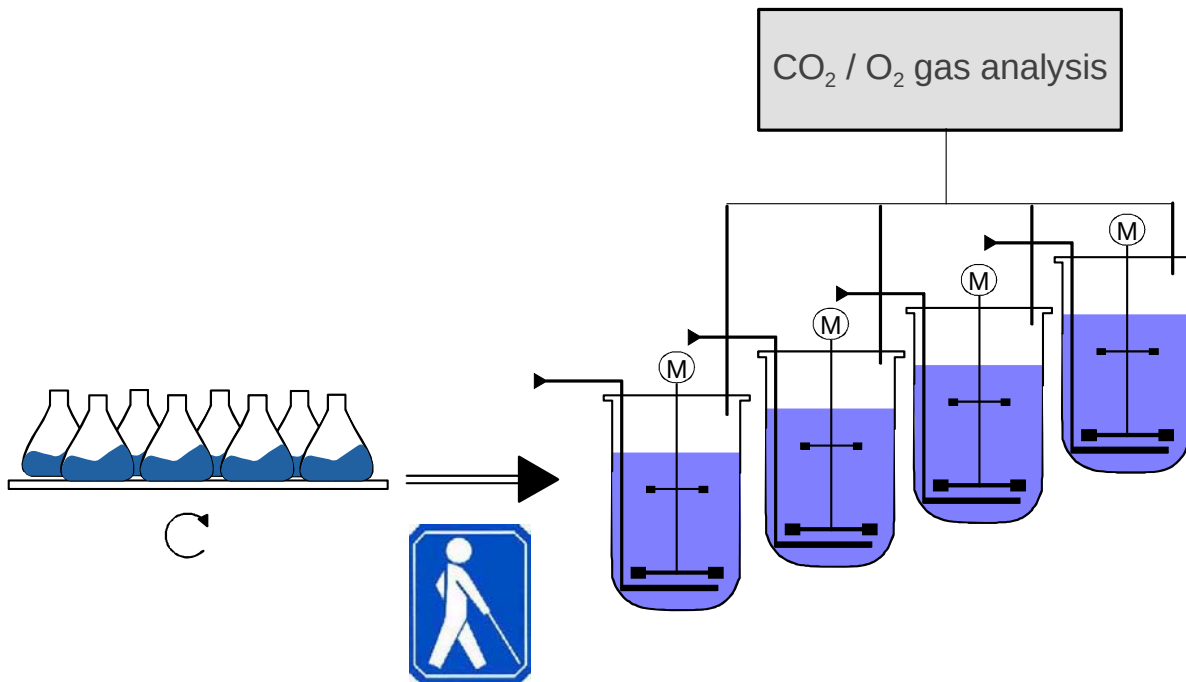




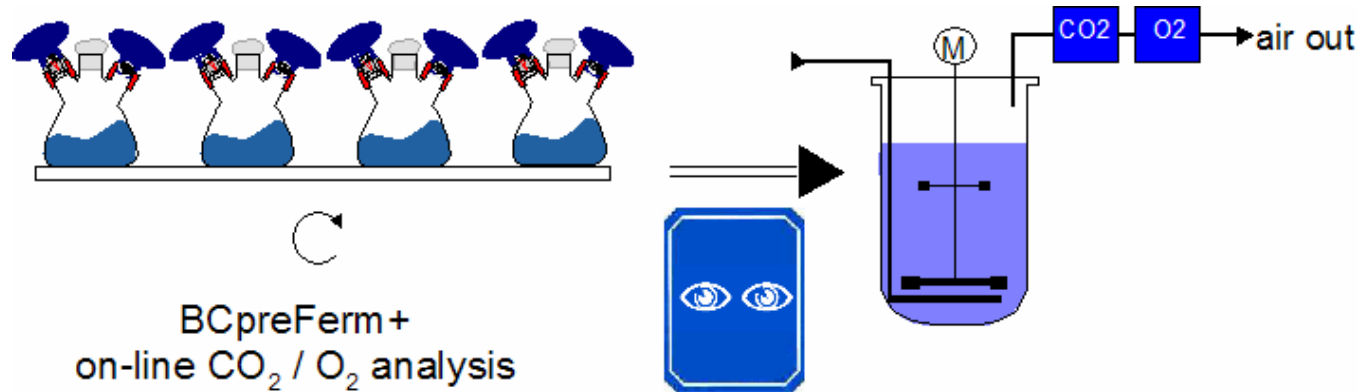
Verlauf der Sauerstoffaufnahme rate OUR und der Kohlendioxidabgaberate CER bei einer Hefe-Fermentation (Quellen: Schering AG, Bergkamen, Engineo GmbH)



“normal” Scale-Up



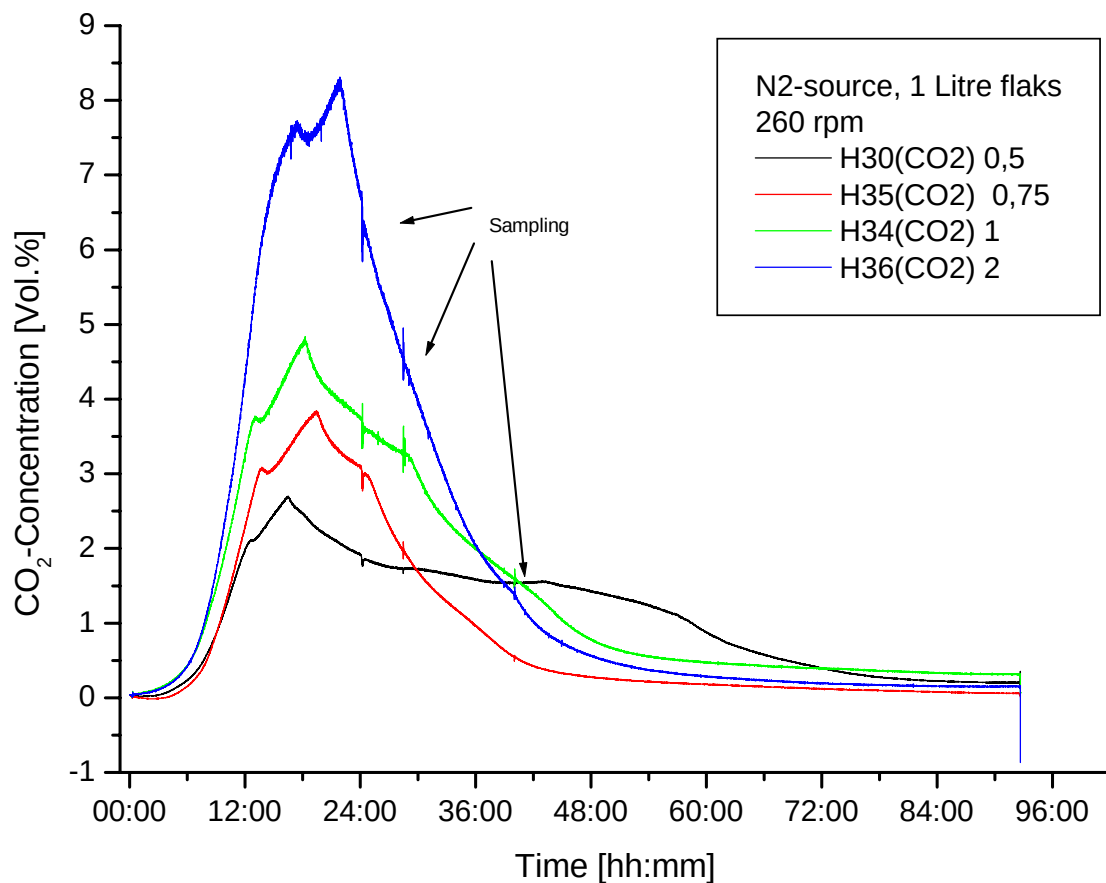
“modern” Scale-Up



BCpreFerm - the power tool

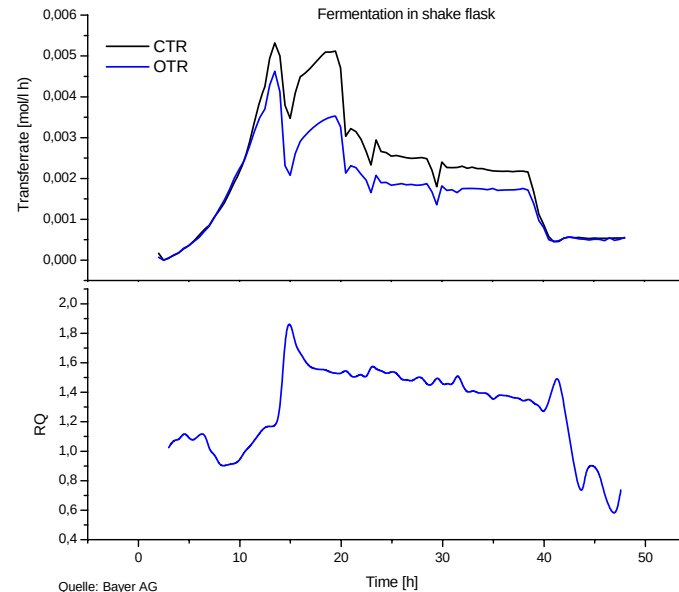
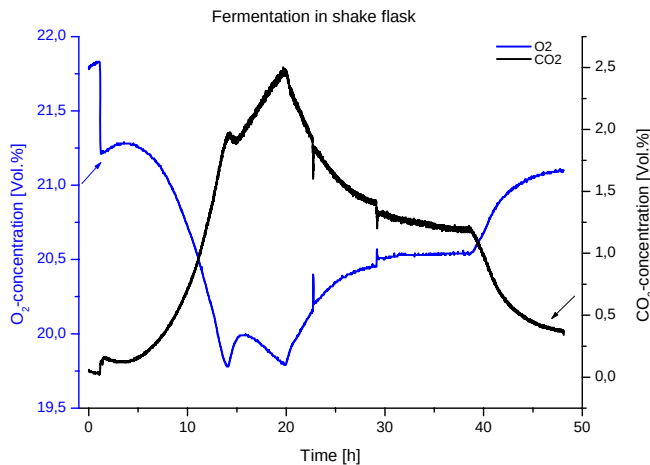


Optimisation of media with BCpreFerm



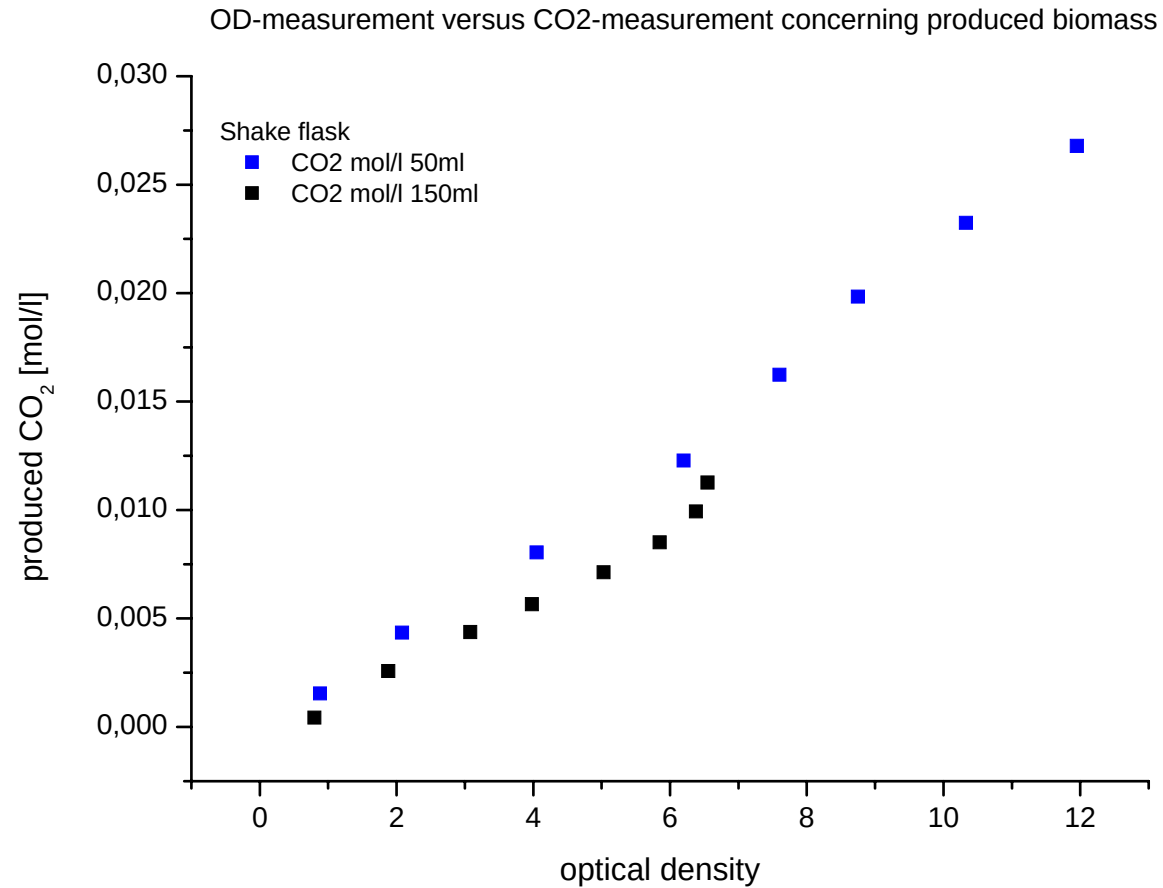
Fermentation in shake flasks

Controlled by BCpreFerm



Quelle: Bayer AG





Why using gas analysis during fermentations?

- Easy to use
- Increasing reproducibility
- Increasing productivity
- More information about the process



Why using sensors instead of analysers?

- Low investment cost
- Rugged
- In-situ on-line measuring
- No gas treatment
- Low maintenance cost
- Easy to use





Gas analysis of the future



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