Considering Carbon and Fermentation vs. Respiration

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Outline

• Point 1
• Point 2
  – 2a
  – 2b
  – 2c
• Point 3
• Point 4
By the time NH$_4^+$ concentration goes from limiting to excess at 61 mM no more fermentation.

- Respiratory quotient shows at 29 mM NH$_4^+$ in the feed, the culture is performing fermentation.
- At 44 mM NH$_4^+$, yeast begin to switch over to respiration.
- After nitrogen is no longer limiting (61 mM NH$_4^+$) complete respiration.

Figure from ter Schure, et al. 1995b
Respiration vs. Fermentation

• Respiration (aerobic)
  - \( \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + 36\text{ATP} \)
  - More energy, less glucose needed, but slower
  - Faster growth rate - ~3 times faster (Novak, et. al., 2007)

• Fermentation (anaerobic)
  - \( 2\text{ATP} + \text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{CH}_3\text{CH}_2\text{OH} + 2\text{CO}_2 + 4\text{ATP} \)
  - Less energy, more glucose needed, but faster

• Use the different growth rates and inefficiencies in the model
What happens at different levels of carbon?

- Biomass
- Carbon Residual
- Nitrogen Residual
And if it is fermentation?

- Biomass
- Residual Carbon
- Residual Nitrogen
Summary

• Yeast may prefer anaerobic metabolism, but aerobic is much more efficient
  – Summ 1a
  – Summ 1b
  – Summ 1c
• Summ 2
• Summ 3
• Summ 4
  – Summ 4a
References


