

QUANTITATIVE METABOLISM

Calculation Method for Distribution Between Catabolism and Anabolism and of Specific Rates

1. Choose the basis for the calculation

$$1 \text{ g GLUCOSE}$$

2. Use the experimental cell yield from substrate ($y_{xs} = \text{g Biomass} / \text{g Substrate}$) to calculate the amount of biomass formed in anabolism (X)

$$X = S_{in} * y_{xs} = y_{xs}$$

3. Use the experimentally measured %C in the cell to calculate the equivalent carbon content of the biomass formed (gC)

$$\text{gC} = (\%C / 100) * X$$

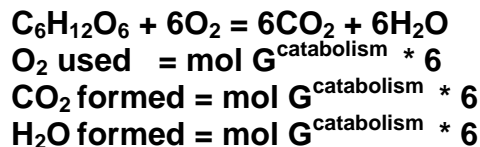
4. Convert gC to the equivalent amount of g Glucose and mol Glucose

$$\begin{aligned} (180/72) * \text{gC} &= \text{g GLUCOSE (G)} \\ \text{G}/180 &= \text{mol GLUCOSE (molG)} \end{aligned}$$

5. Calculate the gC and the mol C associated with catabolism, $G^{\text{catabolism}}$ and $\text{mol G}^{\text{catabolism}}$

$$\begin{aligned} 1 - G &= G^{\text{catabolism}} \\ \text{mol G}^{\text{catabolism}} &= G^{\text{catabolism}} / 180 \end{aligned}$$

6. Use catabolic pathway information to identify and calculate the amount (mols) of end products produced and other compounds used



7. Hence, calculate mols O_2 / g Glucose used

$$\Delta \text{O}_2 / \Delta S = \text{O}_2 \text{ used} / 1 \text{ g Glucose} = (\text{mol G}^{\text{catabolism}} * 6) / 1 \text{ g Glucose}$$

8. Calculate the specific rate of oxygen use and end products formed

$$\begin{aligned} \text{QO}_2 &= (\text{O}_2 \text{ used} / 1 \text{ g Glucose}) * \mu \text{ (h}^{-1}\text{)} / y_{xs} \text{ (g Biomass / g Substrate)} \\ &= \text{mols O}_2 / \text{g Biomass / h} \\ \text{QO}_2 &= \text{QCO}_2 \text{ (mols CO}_2 / \text{g Biomass / h)} \text{ and } \text{QH}_2\text{O (mols H}_2\text{O / g Biomass / h)} \end{aligned}$$