CBP 732: Assignment 1

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1 Mass balance

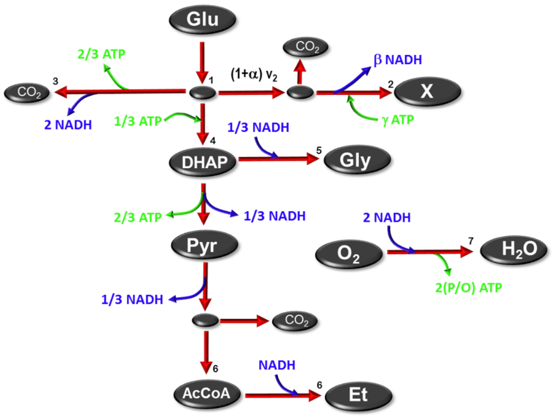

Figure 1: Flux model for yeast

Nodal

$$V_1 = (1+\alpha)V_2 + V_3 + V_4 \tag{1}$$

$$V_4 = V_5 + 1.5V_6 \tag{2}$$

Energy

$$\beta V_2 + 2V_3 - \frac{1}{3}V_5 - 2V_7 = 0 \tag{3}$$

$$-\gamma V_2 + \frac{2}{3}V_3 - \frac{1}{3} + V_6 + 2(PO)V_7 = \Theta \tag{4}$$

Biomass

$$V_2 = \mu \tag{5}$$

$$\mu = D \; if \; D \leq \mu_{max} \tag{6}$$

Oxygen

$$Total_{O_2} = V_7 \tag{7}$$

Carbon dioxide

$$Total_{CO_2} = \alpha V_2 + V_3 + 0.5V_6 \tag{8}$$

2 Discussion

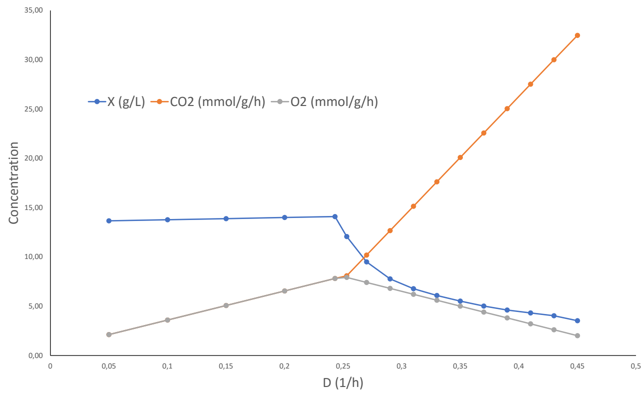

Figure 2: Concentrations for varied dilution rates

It can be see that for the initial increase in dilution rate there is an increase in the biomass concentration however this comes to a point where the dilution rate increases past the point of maximum specific growth rate and the biomass concentration decreases. This implies that the maximum specific growth rate is $\mu_{max} = 0.2431/h$.

This was used together with the above equations to solve for the unknown rates and variables, including the γ. Θ and β were assumed to be equal to 0.1 and 0.1 respectfully. An average molar mass value for biomass of 24.6 g/mol was assumed.

The γ was then solved for and it was found that it varied from 1.8 to 3.33 for a P/O of 1.5 as can be seen in the below graph.

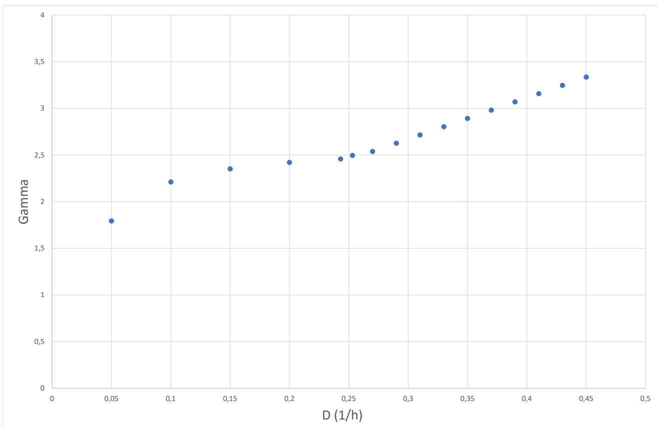

Figure 3: Gamma for varied dilution rates

It was also seen that the gamma increase for an increase P/O value.