

Cell Growth Problem Set 3

A) The following data were obtained for operating a chemostat of *Escherichia coli*:

Dilution Rate (h^{-1})	0.035	0.050	0.080	0.110
X (g/L)	1.30	1.62	1.74	1.99
Glucose in Feed (g/L)	6.86	6.92	6.20	6.45
Glucose in Effluent (g/L)	0.00	0.00	0.01	0.02

- For each dilution rate, calculate the specific glucose consumption rate, q_G .
- For each dilution rate, calculate the observed biomass yield, $Y_{X/S}^{\text{OBS}}$
- Calculate the maintenance and the true biomass yield. Use both the Pirt Plot and the Tempest Plot.

B) You conduct a glycerol-limited chemostat in a defined medium in a 50.0 liter vessel at a dilution rate of 0.115 h^{-1} , and obtain the following information:

Dry Cell Weight = 4.87 g/L

Feed Glycerol = 16.12 g/L

Gas Flowrate (dry basis) STP Inlet = 24.50 L/min

Gas (dry basis) Inlet = 21.05% O_2 , 0.00 % CO_2

Gas (dry basis) Outlet = 18.94% O_2 , 2.67 % CO_2

$R = 0.08206 \text{ L} \cdot \text{atm} / \text{mol} \cdot \text{K}$

$M(\text{glycerol}) = 92.094 \text{ g/mol}$

$M(\text{dry cell, unit C}) = 24.70 \text{ g/mol}$

Calculate or estimate:

- The OUR and CER (units of mmol/Lh).
- The specific oxygen uptake rate of these cells (mmol/gh).
- The heat of metabolism (kcal/h).
- Complete a carbon balance to obtain carbon recovery.
- The observed biomass yield, $Y_{X/S}^{\text{OBS}}$
- How can you 'prove' operationally that the system is glycerol-limited?