

Cell Growth Problem Set 2

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

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

B) The following data were measured in a 40 liter bioreactor by a dissolved oxygen electrode during a cycle in which the air supplied was shut-off and then restarted. (The system automatically restarted the air supply when the DO reached a minimal acceptable value.) The cell concentration at the time the data were collected was 0.96 g/L.

<u>Time (s)</u>	<u>Conc. O₂ (mg/L)</u>
0	6.33
1	6.33
2	6.33
3	5.78
4	5.22
5	4.66
6	4.10
7	3.55
8	2.99
9	2.43
12	2.54
15	3.12
18	3.59
21	3.95
24	4.24
27	4.45
30	4.59
33	4.74
36	4.87

- i. Plot the data (time versus concentration of O₂).
- ii. Calculate the oxygen uptake rate (OUR) in units of mg/L·s.
- iii. Calculate the specific oxygen consumption rate (q_{O_2}) in units of g O₂/g cells·h.
- iv. Determine the mass transfer coefficient ($k_L a$) in units of h^{-1} .
- v. Estimate the heat generated by this culture (kcal/h).