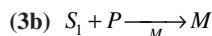


or



The dry weight of the cell is T and is equal to

$$(4) T = S_1 + P + M_1 = \rho V$$

where ρ = cell density and V = cell volume

Write the equations and define all symbols necessary to describe the changes in S_1 , P , M , and T within the cell. Remember that the cell volume is always changing.

6.5. A biochemical engineer has determined in her lab that the optimal productivity of a valuable antibiotic is achieved when the carbon nutrient, in this case molasses, is metered into the fermenter at a rate proportional to the growth rate. However, she cannot implement her discovery in the antibiotic plant, since there is no reliable way to measure the growth rate (dX/dt) or biomass concentration (X) during the course of the fermentation. It is suggested that an oxygen analyzer be installed on the plant fermenters so that the OUR (oxygen uptake rate, g/l-h) may be measured.

- a. Derive expressions that may be used to estimate X and dX/dt from OUR and time data, assuming that a simple yield and maintenance model may be used to describe the rate of oxygen consumption by the culture.
- b. Calculate values for the yield (Y_{X/O_2}) and maintenance (m_{O_2}) parameters from the following data:

Time	OUR (g/h)	X (g/l)
0	0.011	0.60
1	0.008	0.63
2	0.084	0.63
3	0.153	0.76
4	0.198	1.06
5	0.273	1.56
6	0.393	2.23
7	0.493	2.85
8	0.642	4.15
9	0.915	5.37
10	1.031	7.59
11	1.12	9.40
12	1.37	11.40
13	1.58	12.22
14	1.26	13.00
15	1.58	13.37
16	1.26	14.47
17	1.12	15.37
18	1.20	16.12
19	0.99	16.18
20	0.86	16.67
21	0.90	17.01

[Courtesy of D. Zabriskie from "Collected Coursework Problems in Biochemical Engineering," compiled by H. W. Blanch for 1977 Am. Soc. Eng. Educ. Summer School.]