

C.1

Cyanobacteria are able to grow in a medium containing 0.49M NaCl and 0.01M CaCl₂, and this solution is isotonic for the cells. Then, such cells are transferred from this medium into water, and they become permeable. Estimate the osmotic pressure difference which makes the membranes of the cyanobacteria permeable.

C.2

You are homogenizing a cell suspension to release an enzyme using a sonicator. You can release 50% of the enzyme in 8.3 liters in 16 minutes. How long will it take to release 90% of the enzyme in 230 liters?

C.3

You have 1500 L of cells to homogenize using a multi-pass system. The capacity of the homogenizer is 50 L/min.

- a) If you want 99% of the solution to pass through the homogenizer 5 or more times, how long should you operate the recycle?
- b) If you pass the solution through the homogenizer half of the time that you calculated in part a), what fraction of the solution will pass through the homogenizer 5 or more times?
- c) Under the conditions of part b, what fraction of the solution will pass through the homogenizer 3 or more times?
- d) You decide to operate the recycle multi-pass system for 240 minutes.
 - i) Approximately how many times through the homogenizer did 99% of the solution pass?
 - ii) Approximately what fraction of the solution passed through the homogenizer 5 or more times?

C.4

You have 2000 L of cells to homogenize using a multi-pass system. The capacity of the homogenizer is 60 L/min.

- a) Using an alternating batch process, how much time is required to pass the cells through the homogenizer 4 times?
- b) In a continuous-batch process, if you want 90% of the solution to be homogenized 4 or more times, how long should you operate the recycle?
- c) Under the conditions of part b) in the continuous-batch process, what fraction of the solution will pass through the homogenizer 8 or more times?
- d) Under the conditions of part b) in the continuous-batch process, what fraction of the solution will pass through the homogenizer exactly 4 times?
- e) You decide to operate the continuous-batch process 150 minutes.
 - i. What fraction of the solution passed through the homogenizer 4 or more times?
 - ii. What fraction of the solution passed through the homogenizer 8 or more times?
 - iii. What fraction of the solution did not pass through the homogenizer?
 - iv. You can be sure that 5% of the solution passed through the homogenizer how many times or more?