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PROBLEMS

11.1. Yeast cells are recovered from a fermentation broth by using a tubular centrifuge. Sixty percent (60%) of the cells are recovered at a flow rate of 12 l/min with a rotational speed of 4000 rpm. Recovery is inversely proportional to flow rate.

a. To increase the recovery of cells to 95% at the same flow rate, what should be the rpm of the centrifuge?

b. At a constant rpm of 4000 rpm, what should be the flow rate to result in 95% cell recovery?

11.2. Gentamycin crystals are filtered through a small test filter medium with a negligible resistance. The following data were obtained:

t (sec)	10	20	30	40
V (l)	0.6	0.78	0.95	1.1

The pressure drop in this test run was 1.8 times that when water was used with a filter area of 100 cm^2. The concentration of gentamycin in solution is 5 g/l. How long would it take to filter 5000 l of gentamycin solution through a filter of 1.5 m^2, assuming the pressure drop is constant and $\mu = 1.2$ centipoise?

11.3. Streptomycin is extracted from the fermentation broth using an organic solvent in a countercurrent staged extraction unit. The distribution coefficient of streptomycin at pH = 4 is $K_D = Y_i/X_i = 40$, and the flow rate of the aqueous (H) phase is $H = 150$ l/min. If only five extraction units are available to reduce the streptomycin concentration from 10 g/l in the aqueous phase to 0.2 g/l, determine the required flow rate of the organic phase (L) in the extraction unit.

11.4. A new antibiotic is separated from a fermentation broth by adsorption on resin beads in a fixed bed. The bed is 5 cm in diameter and contains 0.75 cm^3 resin/cm bed. The overall mass transfer coefficient is 12 h^{-1}. If the antibiotic concentration in the feed is 4 g/l and is desired