a. Derive an expression for the residual substrate concentration (i.e., S) as a function of dilution rate and the kinetic parameters (μ_m, K_S, K_I).

b. What are the implications for operation of a chemostat when the organism is subjected to substrate inhibition?

6.19. Formation of lactic acid from glucose is realized in a continuous culture by *Streptococcus lactis*. The following information was obtained from experimental studies.

$S_0 = 5$ g/l, $\mu_m = 0.2$ h^{-1}, $K_S = 200$ mg/l, $k_d = 0.002$ h^{-1}, $Y^M_{X/S} = 0.4$ g X/g S, $Y_{P/S} = 0.2$ g P/g S, $q_P = 0.1$ g P/g X-h.

a. Plot the variations of *S, X, P,* DX, and DP with dilution rate.

b. Determine (graphically) the optimum dilution rate maximizing the productivities of biomass (DX) and the product (DP).