Conversions

water at normal conditions: 7.48 gal/ft^3 62.4 lb/ft^3 3.785 L/gal 8.34 lb/gal

454 g/lb 2.54 cm/in 1000 L/m^3

Equations

$y = L_0(1-10^{-k\cdot t})$ $\quad \frac{dD}{dt} = k_1 L - k_2 D$ $\quad G = \sqrt{\frac{P}{\mu \cdot V}}$ $\quad g = 9.81\ m/s^2$

$Q = \frac{V}{\tau}$ $\quad$ PFR: $C = C_0 e^{-k\cdot\tau}$ (first order) $\quad OR = Q/A_s$

PFR: $1/C = 1/C_0 + k\cdot\tau$ (second order)

$L_m Q_m = L_s Q_s + L_w Q_w$ $\quad \frac{F}{M} = \frac{\text{lb } BOD_5 \text{ fed to the system per day}}{\text{lb MLVSS}}$

$K_T = K_{20}\theta^{(T-20)}$ $\quad N/N_0 = e^{-r\cdot t}$ $\quad k = A_0 \cdot e^{-\frac{E_a}{R\cdot T}}$

$\theta = 1.135$ $(4 < T < 20)$

$\theta = 1.056$ $(20 < T < 30)$

$$X_{(x,y,0)} = \frac{Q}{\pi S_y S_z U}\left(\exp\left[-\frac{1}{2}\left(\frac{y}{S_y}\right)^2\right]\cdot\exp\left[-\frac{1}{2}\left(\frac{H}{S_z}\right)^2\right]\right) \qquad Re = \frac{v_t \cdot D \cdot \rho_l}{\mu}$$

$v_t = \frac{D^2(\rho_s - \rho_l)g}{18\mu}$ $\quad TS = DS + SS = FDS + VDS + FSS + VSS$ $\quad \frac{dN}{dt} = -kN$

$\text{CSTR}: \frac{C}{C_0} = \frac{1}{1+k\cdot\tau}$ (first order) $\quad \theta_C = \frac{\text{mass MLVSS in system}}{\text{mass MLVSS leaving per day}}$

$E = \frac{\text{volume of solid waste} + \text{volume of cover}}{\text{volume of solid waste}}$ $\quad V_{LF} = \frac{(\text{mass of waste delivered / time}) \cdot E}{\text{compacted density}}$

SVI = Settled Sludge Volume/MLSS * 1000 $\quad X_r = 10^6/SVI$

$$h_L = \frac{1.067 \cdot V_a^2 \cdot D}{\phi \cdot g \cdot \varepsilon^4}\sum_{i=1}^{n}\frac{C_D \cdot f}{d}$$

$C_D = \frac{24}{Re}$

$C_D = \frac{24}{Re} + \frac{3}{\sqrt{Re}} + 0.34$

$S = \frac{K_S}{\theta_C \cdot \mu_{max} - 1}$ $\quad X = Y(S_0 - S)\frac{\theta_C}{\theta}$