Announcements

- Ames WPCF Field Trip Report due today
Practice Problems

6-18 BOD$_5$ going to 1$^o$ clarifiers = 345 mg/L

Q = 0.05 m$^3$/s

BOD$_5$ removal efficiency = 30%

how many kg of BOD$_5$ are removed/day

\[
\frac{0.05 \text{ m}^3}{\text{s}} \times \frac{60 \text{ s}}{\text{m}} \times \frac{60 \text{ m}}{\text{n}} \times \frac{24 \text{ h}}{\text{d}} \times \frac{345 \text{ mg}}{1 \text{ L}} \times \frac{1000 \text{ L}}{1 \text{ m}^3} \times \frac{9}{1000 \text{ mg}} \times \frac{k_3}{1000 \text{ g}} \times 0.3
\]

= 447 kg/d

= 984 #/d
6-26

Permit = 25 mg/l BODs
30 mg/l SS
Q = 0.025 m³/s

\( \theta_{eff} = 240 \text{ mg/l} \)

\( \theta_{o} \) of aeration basin

\( \text{BODs of SS} = 0.7 \)

\( \text{design MLVSS} = 3,000 \text{ mg/l} \)

\( \frac{Y}{\text{mg BODs}} = 0.8 \frac{\text{mg VSS}}{} \)

\( k_s = 100 \text{ mg/l BODs} \)

\( k_d = 0.025 \text{ d}^{-1} \)

\( M_{max} = 10 \text{ d}^{-1} \)

1. find \( S_{design} \)
2. find \( \theta_c \)
3. find \( \theta \) given \( x \)
4. find \# of aeration tank

1. \( S_{design} = \text{BODs permit} - \text{BODs solids} \)

\( = 25 - 30(0.7) = 4 \text{ mg/l as BODs} \)

2. \( \theta_c = \frac{k_s + S}{S(\mu - k_d)} - k_s k_d = \frac{100 + 4}{4(10 - 0.025) - 100(0.025)} = 2.78 \text{ d} \)
3. Calc $\theta$ given $x$

$$\theta = \frac{\theta_c \gamma (S_0 - S)}{X (1 + k_1 \theta_c)} = \frac{2.78(0.8)(240-4)}{3000(1 + 0.025(2.78))}$$

$$\theta = 0.1636 \text{ d}$$

$V_01 = Q \theta = 0.029 \frac{m^3}{s} \times 0.1639 \text{ d.} 60.60.24 = 410 \text{ m}^3$

Find $Q_r$ at say $20^\circ \text{C}$; assume $x' = 1.2 \times (x)$

$$\frac{Q}{Q + Q_r} = \frac{x'}{x}$$

$S_{V1} = 135 \frac{mL}{g}$

$$x_r' = \frac{10^6}{135} \approx 7407$$

$$x' = 3000 \text{ mg/L}$$

$$x = 3000 \text{ mg/L}$$

$$x_r' = 3600 \text{ mg/L}$$
\[(Q + Q_r) x' = Q_r x' \]
\[\frac{L}{3600} \quad L = 7407\]

\[(Q + Q_r) 3600 = Q_r 7407\]

\[0.029\]
\[3600 (0.029) + 3600 Q_r = 7407 Q_r\]

\[Q_r = \frac{3600 (0.029)}{7407 - 3600} = 0.027 \text{ m}^3 \text{ s}^{-1}\]
Suggested maximum MLSS concentration

\[ Q_r = Q \]

\[ Q_r \leq Q \]

Conditions:
SVI at aerator temperature,
Not ambient temperature
Recycle ratio

\[ Q = \frac{0.027}{0.029} = 1 \]
Wastewater Treatment Plant Photos
Boone wastewater treatment plant
Boone wastewater treatment plant
Wastewater treatment plants
Wastewater treatment plants
Back River WWTP
Back River WWTP
Back River WWTP
Back River WWTP
Abu Dhabi WWTP
Abu Dhabi WWTP
Abu Dhabi WWTP
Abu Dhabi WWTP
Abu Dhabi WWTP
Budapest WWTP
Lake Balaton WWTP
Lake Balaton WWTP
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Wastewater Treatment in Developing Countries

Community Biogas Plant in China
Settling Problem in Activated Sludge
Summary of sludge processing

- **Thickening**
  - Water removal
  - Volume reduction

- **Digestion**
  - Pathogen destruction
  - Odor control
  - Gas production
  - Stabilization of organic matter

- **Conditioning**
  - Improved dewatering/thickening rate
  - Improved compactability
  - Stabilization

- **Dewatering**
  - Pathogen destruction
  - Odor control
  - Gas production
  - Stabilization of organic matter

- **Incineration and Wet Oxidation**
  - Volume and weight reduction
  - Reduction of fuel requirements for incineration/drying

- **Final Disposal**
  - Ocean dumping*
  - Landfill
  - Land application
  - Incineration
Filter Press
View of machine used to aerate compost placed in windrows.
Schematic of static aerated compost pile
Biosolids land application

**a) Injecting Sludge**

**b) Sludge-Treated Soil**
Placement of geomembrane liner in area-type landfill