Certification Boulevard

Test Your Knowledge of Miscellaneous Technical Topics

1. What does the "M" represent in the process parameter F/M ratio?

   a. lbs volatile microorganisms in aeration
   b. gpd plant flow
   c. lbs/day influent $CBOD_5$ entering aeration
   d. gpd waste sludge leaving aeration

2. What may be the cause if $CBOD_5$ removal in a primary clarifier is less than 15%?

   a. The plant is underloaded
   b. The detention time is too short
   c. The detention time is too long
   d. 15% $CBOD_5$ removal from a primary clarifier is greater than expected

3. What is a typical range for gas production in a properly operated anaerobic digestion process?

   a. 1 to 2 ft^3 per lb VS reduced
   b. 5 to 7 ft^3 per lb VS reduced
   c. 11 to 20 ft^3 per lb VS reduced
   d. 40 to 60 ft^3 per lb VS reduced

4. What is created when chlorine reacts with ammonia in the effluent stream?

   a. Chloramines
   b. Free residual
   c. Mono residual
   d. Combined residual
   e. Both "a & d"

5. Which group of bacteria are responsible for converting NO_2 to NO_3?

   a. Heterotrophic
   b. Nitrosomonas
   c. Nitrobacter
   d. Fermenters

6. Given the following data, what is the sludge blanket detention time in a secondary clarifier?

   - 50 Foot Diameter
   - 3 Foot Sludge Blanket Depth
   - 2:12 Floor Slope
   - 0.5 mgd RAS Rate

   a. 2.6 days
   b. 3.1 hours
   c. 2.1 hours
   d. 1.3 days

Sludge Blanket Detention Time, hours

$$= \frac{\text{Total Gallons of Sludge in Clarifier}}{\text{RAS Rate, gpd}} \times 24 \text{ hrs/day}$$

Gals Sludge in Blanket = πr^2 x blanket depth x 7.48
3.14 x 25 ft x 25 ft x 3 ft. x 7.48 gal/ft^3
44,038 gals

Gals Sludge in Cone = $\frac{1}{3} \pi r^2$ x cone depth x 7.48
(3.14 x 25 ft x 25 ft x (50 ft ÷ 12 in/ft) x 7.48 gal/ft^3) ÷ 3
20,388 gals

$$= \frac{\text{44,038 gals in blanket + 20,388 gals in cone}}{\text{500,000 gpd RAS}} \times 24 \text{ hrs/day}$$

= 3.09 hours

7. Given the following data, what is the cost of polymer used, in dollars per dry ton of sludge processed by a Belt Filter Press?

   - Total sludge feed is 144,250 gpd
   - Feed sludge concentration is 2.75% TS
   - Total neat polymer used is 35 gpd
   - Polymer specific gravity (S.G.) is 1.03
   - Polymer cost is $0.69 per pound

   a. $45.24 per dt
   b. $12.54 per dt
   c. $37.64 per dt
   d. $12.18 per dt

   Cost of Polymer per Dry Ton of Sludge Processed

   $$= \frac{\text{Total Cost of Polymer Utilization}}{\text{Total Dry Tons Sludge Processed}}$$

   Total Cost of Polymer Used = gpd neat polymer used x weight per gal x $ per pound

   = 35 gpd x (8.34 lbs/gal x 1.03 S.G.) x $0.69 per lb

   = $207.45 per day polymer used

   Total Dry Tons Sludge = lbs/day sludge feed ÷ 2,000 lbs/ton

   = (0.14425 mgd x 27,500 mg/l x 8.34 lbs/gal) ÷ 2,000

   = 16.54 dtpd (dry tons per day)

   $$\text{Cost per Dry Ton} = \frac{\text{\$207.45 per day}}{\text{16.54 dtpd}}$$

   = $12.54 polymer per dry ton sludge processed

8. Given the following data, what is the Specific Oxygen Utilization Rate (SOUR) in an aerobic digester?

    - OUR test starting D.O. is 7.2 mg/l
    - OUR test ending D.O. is 4.0 mg/l
    - OUR test time is 10 minutes
    - Digested sludge VSS concentration is 14,500 mg/l
    - Digested sludge volatile fraction is 70%

    a. 1.32 mg/hr/gm
    b. 0.78 mg/hr/gm
    c. 1.6 mg/hr/gm
    d. 0.93 mg/hr/gm

    $$\text{SOUR, mg/hr/gm TS} = \frac{\text{OUR, mg/l/hr}}{\text{TS, gm/l}}$$

    $$\text{OUR, mg/l/hr} = \frac{\text{Starting D.O., mg/l} - \text{Ending D.O., mg/l}}{\text{Test Time, mins}} \times 60 \text{ mins/hr}$$

    $$= \frac{7.2 \text{ mg/l} - 4.0 \text{ mg/l}}{10 \text{ mins}} \times 60 \text{ mins/hr}$$

    $$= 19.2 \text{ mg/l/hr}$$

    $$\text{TS, gm/l} = (\text{VSS, mg/l} \div \text{Volatile Fraction, \%}) \div 1{,}000 \text{ mg/gm}$$

    $$= (14{,}500 \text{ mg/l} \div 0.7) \div 1{,}000 \text{ mg/gm}$$

    $$= 20.71 \text{ gm TS}$$

    $$\text{SOUR, mg/hr/gm} = 0.93 \text{ mg/hr/gm}$$

9. Which effluent quality condition may cause the most efficiency problems with a UV disinfection process?

    a. High NH_3
    b. High NO_3
    c. High NO_2
    d. High TSS

10. What is the term when NH_3-N and Org-N are added together?

    a. TN
    b. SON
    c. NO_3
    d. TKN
    e. NO_2
    f. NO_x
    g. None of the above