Certification Boulevard

Test Your Knowledge of Residuals Management
Answer Key

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

   - OUR test starting D.O. is 6.8 mg/L
   - OUR test ending D.O. is 3.5 mg/L
   - OUR test time is 10 minutes
   - Digested sludge total solids concentration is 1.2%

   a. 2.1 mg/hr/gm TS
   b. 1.1 mg/hr/gm TS
   c. 1.65 mg/hr/gm TS
   d. 10.9 mg/hr/gm TS

   SOUR, mg/hr/gm TS = OUR, mg/L/hr ÷ TS, gm/L
   (6.8 mg/l – 3.5 mg/L) ÷ 10 minutes x 60 mins/hr = 19.8 mg/L/hr OUR

   gm/L TS = mg/L TSS ÷ 1,000

   1.2% TS x 10,000 = 12,000 mg/L TSS
   19.8 mg/L/hr ÷ (12,000 ÷ 1,000)
   = 1.65 mg/hr/gm TS

2. Based on Question No.1, does this aerobic digester meet EPA's vector attraction reduction regulation for Class B residuals?

   a. Yes
   b. No
   c. Not enough data to answer this question

   The standard for SOUR to satisfy vector attraction reduction requirements for aerobic digestion is to be no more than 1.5 mg/hr/gm TS.

3. Given the following data, what is the percent volatile solids reduction in an anaerobic digester using the Approximate Mass Balance (AMB) formula?

   - Feed Sludge Total Solids = 3.4%
   - Feed Sludge Volatile Solids = 2.7%
   - Feed Sludge Daily Flow = 0.09 mgd
   - Digested Sludge Out Total Solids = 2.4%
   - Digested Sludge Out Volatile Solids = 1.5%
   - Digested Sludge Out Flow = 0.09 mgd

   a. 40.1%
   b. 37.0%
   c. 34.5%

d. 44.4%

Approximate Mass Balance formula
= (VS in, lbs/day – VS Out lbs/day) ÷ VS in, lbs/day x 100 = % VS reduction

VS in, lbs/day = 0.09 mgd x 27,000 mg/L x 8.34 lbs/gal = 20,266 lbs/day
VS out, lbs/day = 0.09 mgd x 15,000 mg/L x 8.34 lbs/gal = 11,259 lbs/day

(20,266 – 11,259) ÷ 20,266 ***x 100***
= 44.4% VS reduction

4. What happens to the pH in an aerobic digester when carbon dioxide is stripped out of the sludge?

a. The pH decreases
b. The pH increases
c. Carbon dioxide does not affect pH
d. Alkalinity is increased

5. What are the requirements for lime stabilization to accomplish Class B stabilization standards?

a. Raise the sludge pH to no greater than 11.0
b. Raise the sludge pH to at least 12 for the first 2 hours, and then maintain at least 12.5 for the next 24 hours
c. Raise the sludge pH to 10.0 to 10.5 for 30 minutes
d. Raise the sludge pH to at least 12 for the first 2 hours, and then maintain at least 11.5 for the next 22 hours

6. Given the following data, what is the volatile solids loading rate in an anaerobic digester?

- Digester tank diameter is 75 feet
- Digester side water depth is 24 feet to overflow
- Volume in cone is 35,000 gallons
- Digester sludge feed rate is 125 gpm for 8 hrs/day
- Sludge feed total solids concentration is 3.2%
- Sludge feed volatile content is 81%

a. 0.12 lbs per day VS per ft^3
b. 0.34 lbs per day VS per ft^3
c. 0.15 lbs per day VS per ft^3
d. 1.5 lbs per day VS per ft^3

VS loading rate, lbs VS per day per ft^3 digester capacity
= lbs/day VS feed to digester ÷ ft^3 digester capacity

flow to digester = 480 mins/day x 125 gpm = 60,000 gpd = 0.06 mgd
volatile solids fraction = 3.2% TS x 81% volatile = 2.592% volatile fraction

lbs/day VS feed = 0.06 mgd x 25,920 mg/L VS x 8.34 lbs/gal
= 12,970 lbs/day VS feed to digester

digester ft3 capacity = (π r^2 x SWD, ft) + (cone volume ÷ 7.48 gal/ft^3)
(3.14 x 37.5 ft x 37.5 ft x 24 ft SWD) + (35,000 gallons in cone ÷ 7.48 gal/ft3)

105,975 ft^3 + 4,679 ft^3 = 110,654 ft^3

12,970 lbs/day VS ÷ 110,654 ft^3
= 0.117 lbs/day VS per ft^3 digester capacity

7. Which is the EPA rule that provides rules and regulation for the disposal of wastewater residuals?

a. 305 rule
b. 640 rule
c. 736 rule
d. <u>503 rule</u>

8. Given the following data, what is the annual budget for lime in a lime stabilization process?

- Lime dose rate is 5.5% per wet ton of sludge
- Sludge wet weight is 28,690 lbs/day
- Lime cost is $120.00 per ton delivered
- Sludge is processed 7 days per week

a. $36,145
b. $14,345
c. <u>$34,557</u>
d. $28,274

tons/day lime used = sludge wet weight, tons/day x lime dose, %
28,690 lbs wet sludge ÷ 2,000 lbs/ton = 14.345 ton/day wet sludge

14.345 tons/day wet sludge x 0.055 lime dose = 0.788975 tons/day lime used
tons/year lime used = 0.788975 tons/day x 365 days/year = 287.976 tons/year lime used

287.976 tons/year lime used x $120.00 per ton of lime delivered
= $34,557.10 per year lime cost

9. What is one of the alternate methods for vector attraction reduction for an anaerobic digestion process if the volatile solids reduction does not meet the required number?

a. Chlorine residual
b. SOUR
c. <u>Extended 40-day bench test</u>
d. Ammonia-nitrogen
e. None of the above

10. What is the fecal coliform limit to meet standards for Class B biosolids?

a. 1,000 #/gram TS
b. 10,000 #/gram TS
c. 1,000,000 #/gram TS
d. **<u>2,000,000 #/gram TS</u>**