Certification Boulevard

Test Your Knowledge of Wastewater Treatment Topics · Answer Key

1. Given the following data, what is the solids loading rate on the secondary clarifiers?

    - Plant Influent Flow is 23.75 mgd
    - The RAS Rate is 70% of Q
    - There are six (6) 100 ft Diameter Secondary Clarifiers
    - The Aeration MLSS is 2,250 mg/L

    a. 21.5 lbs/day/ft^2
    b. 16.1 lbs/day/ft^2
    c. 2.8 lbs/day/ft^2
    d. 96.5 lbs/day/ft^2

Formula

$$\frac{\textit{Total lbs/day Entering the Secondary Clarifiers} = 757{,}637 \text{ lbs/day}}{\textit{Total Clarifiers Surface Area} = 47{,}100 \text{ ft}^2} = 16.09 \text{ lbs/day/ft}^2$$

Total lbs/day Entering the Secondary Clarifiers =
(23.75 mgd + 16.62 mgd) x 2,250 mg/L x 8.34 lbs/gal = 757,637 lbs/day

Total Clarifiers Surface Area = 3.14 x (50 ft x 50 ft) x 6 Clarifiers =47,100 ft^2

2. Given the following Ortho P data for inlet and outlet of a BNR fermentation tank, does this appear to be a problem?

    - Fermentation Inlet Ortho P is 7.0 mg/L
    - Fermentation Outlet Ortho P is 4.0 mg/L

    a. Yes, the Ortho P is too low in the fermentation tank outlet
    b. Yes, the fermentation outlet Ortho P should be 2 to 3 times the concentration of the inlet
    c. No, the fermentation tank is designed to remove phosphorus directly
    d. Both "a & b"

3. Given the following data, and using the data provided in question 1, what is the F/M ratio of this activated sludge process?

    - Influent $CBOD_5$ is 220 mg/L
    - Primary Clarifier Removes 26% of the Influent $CBOD_5$
    - MLVSS is 75% of MLSS
    - Eight (8) Aeration Tanks Each 220 Feet Long, 45 Feet Wide and 15 Feet Deep

    a. 0.42
    b. 0.13
    c. 0.26
    d. 0.11

F/M/ Ratio = lbs/day $CBOD_5$ Entering Aeration divided by lbs MLVSS in Aeration

Lbs/day $CBOD_5$ Entering Aeration = 23.75 mgd x 162.8 mg/L x 8.34 lbs/gal
= 32,247 lbs/day $CBOD_5$

Lbs MLVSS in Aeration = (220 ft x 45 ft x 15 ft x 7.48 gal/ft^3 ÷ 1,000,000) x 8 Aeration Tanks x 1,688 mg/L x 8.34 lbs/gal = 125,100 lbs MLVSS

32,247 lbs/day $CBOD_5$ ÷ 125,100 lbs MLVSS
= 0.258 F/M

4. What is the best adjustment (from the list of possible answers) to make if solids are rising in the secondary clarifier accompanied by large gas bubbles and strong odors?

    a. Increase aeration D.O.
    b. Decrease the RAS rate
    c. Decrease the WAS rate
    d. Decrease aeration D.O.

This septic condition requires an increased aerobic environment in the MLSS.

5. What is a typical RAS to Q ratio for a contact stabilization activated sludge process?

    a. 50% to 75%
    b. 20% to 50%
    c. 1% to 2%
    d. 75% to 150%

6. Given the following data, calculate the Respiration Rate (RR)?

    - Beginning OUR Test D.O. is 7.8 mg/L
    - Ending OUR Test D.O. is 2.2 mg/L
    - Test Time is 10 Minutes
    - MLVSS is 1,688 mg/L

    a. 0.019 mg/hr/gm
    b. 19.9 mg/hr/gm
    c. 33.6 mg/hr/gm
    d. 56.7 mg/hr/gm

RR, mg/hr/gm = OUR, mg/L/hr ÷ MLVSS, gm/L

OUR, mg/L/hr = (Start D.O., mg/L – Ending D.O., mg/L) ÷ Test Time, mins x 60 mins/hr

(7.8 mg/L – 2.2 mg/L) ÷ 10 mins x 60 mins/hr
= 33.6 mg/L/hr OUR

RR, mg/hr/gm = 33.6 mg/L/hr ÷ (1,688 mg/L ÷ 1,000)
= 19.9 mg/hr/gm

7. Given the following data, calculate the daily volume of WAS to be removed from this activated sludge process.

    - Aeration Volume 2.25 mg
    - MLSS 2,750 mg/L
    - MLVSS 2,100 mg/L
    - Desired SRT 7 days
    - WAS Concentration 6,500 mg/L

    a. 13,600 gpd
    b. 1.36 mgd
    c. 0.104 mgd
    d. 0.136 mgd

MLSS Inventory ***= Aeration Tank Volume, mg x MLSS, mg/L x 8.34 lbs/gal***
= 2.25 mg x 2,750 mg/L x 8.34 lbs/gal
= 51,604 lbs Aeration MLSS

Lbs/day WAS to Remove ***= Aeration Inventory, lbs MLSS ÷ Desired SRT, days***
= 51,604 lbs MLSS ÷ 7 days
= 7,372 lbs/day WAS to Remove

Gallons WAS To Remove ***= Lbs/day WAS to Remove ÷ (WAS Concentration x 8.34 lbs/gal)***
= 7,372 lbs/day ÷ (6,500 mg/L x 8.34 lbs/gal)
= 0.1359896 mgd or 135,990 gpd

8. Which process adjustment typically increases the contact time in the aeration tank?

    a. Lower the weir
    b. Increasing the air supply rate
    c. Decreasing the RAS rate
    d. Decreasing the WAS rate

9. What problems can grit cause in downstream treatment processes if it is not removed from the influent flow?

    a. Erode valve seats
    b. Take up valuable space in tanks
    c. Erode pipes and elbows
    d. Damage pump impellers
    e. All of the above

10. Which adjustment will typically improve denitrification in an aeration tank?

    a. Increase the air supply
    b. Increase the D.O.
    c. Decrease the D.O.
    d. Shut off the RAS

Please forward your comments and sample questions for publication to:

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