

Chapter Assessment

1. What is the activated sludge floc made of
2. What properties of activated sludge floc are key to the effectiveness of the activated sludge process
3. List the activated sludge process control parameters (names/description)
4. List the key design differences between a rectangular and circular primary clarifier
5. Why is it important to ensure having a "good" microbiological composition of the activated sludge process (5 points)
6. What is/are the main factor/s that control the microbial population
7. MLVSS represents the fraction of the MLSS
8. Optimal range of SVI is between to
9. Straggler floc is associated with [type1] sludge while pin-floc is associated with sludge Bulking and foaming is due to bacteria
10. Portion of the activated sludge floc settled in the clarifier that is returned to the front of the aeration basin to seed the incoming primary effluent is called [name]
11. List the key design differences between a rectangular and circular primary clarifier Correct Answer(s):
12. Why is it important to ensure having a "good" microbiological composition of the activated sludge process (5 points)

Correct Answer(s):

1. What is/are the main factor/s that control the microbial population Correct Answer(s):
2. Which one of the following statements is TRUE regarding the various modifications of the acti- vated sludge process
   1. MCRT of 5 to 10 days is typical for extended aeration

\*b. Typical hydraulic detention times in the contact tank of the contact stabilization process need only be 0.5 to 1.0 hour.

1. F to M ratios of 0.03 to .1 are appropriate for the step-aeration mode of the activated sludge

# 176 Chapter 11. Activated Sludge

process

1. Pure oxygen activated sludge floc often has a large population of rotifers.
2. Step feed -aeration involves decreasing the air being fed along the length of the aeration tank.
3. What is the significance/importance of measuring OUR and SOUR and what are their respective units of measurement

Correct Answer(s):

1. List the advantages and disadvantages of the constant RAS flow control Correct Answer(s):
2. Name and describe the two RAS control approaches Answer the following related to activated sludge floc:
3. What is the activated sludge floc made of (3 points)
4. What properties of activated sludge floc are key to the effectiveness of the activated sludge process (3 points)
5. List the activated sludge process control parameters (names/description)
6. Activated sludge is an anaerobic process
   1. True

\*b. False

1. Secondary treatment is mainly to remove the organic content of the wastewater

\*a. True

b. False

1. The contents of an aeration tank utilized in activated sludge treatment is referred to as mixed liquor.

\*a. True

b. False

1. In conventional activated sludge plants, six to eight hours of aeration detention time is used for acceptable plant operation.

\*a. True

b. False

1. Bulking occurs in primary clarifiers and is associated with improper scum removal.
   1. True

\*b. False

1. Contact stabilization is a modification of the conventional activated sludge system.

\*a. True

b. False

1. Contact stabilization is a modification of the conventional activated sludge system.

\*a. True

b. False

1. In secondary settling tanks, the sludge pumping considerations would be the same as in primary settling tanks.
   1. True

\*b. False

1. The main function of a launder in a secondary clarifier is to prevent scum and other floatables from leaving with the effluent flow

a. T

@Incorrect. Launder collects and conveys the effluent flow. Effluent baffles prevent scum and other floatables from leaving with the effluent flow

## 11.6 Process modifications 177

\*b. F

@Correct. Launder collects and conveys the effluent flow. Effluent baffles prevent scum and other floatables from leaving with the effluent flow

1. Activated sludge is an anaerobic process
   1. True

\*b. False

1. Excessive filamentous bacteria in activated sludge is typically controlled by bleach addition to RAS

\*a. True

b. False

1. SVI is a measure of the sludge volume that needs to be wasted
   1. True

\*b. False

1. Extended aeration involves operating the activated sludge process at a high F:M ratio
   1. True

\*b. False

1. Sludge bulking is caused by light sludge not settling properly

\*a. True

b. False

1. pH has little effect on the activated sludge plant
   1. True

\*b. False

1. Bulking is caused by excessive filamentous bacteria

\*a. True

b. False

1. Excessive filamentous bacteria in activated sludge is typically controlled by bleach addition to RAS

\*a. True

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1. Extended aeration involves operating the activated sludge process at a high F: M ratio
   1. True

\*b. False

1. In conventional secondary wastewater treatment processes, aerobic decomposition of solids will occur.

\*a. True

b. False

1. In the activated sludge process, the wastewater oxygen demand may be separated into two cate- gories: carbonaceous and nitrogenous

\*a. True

b. False

1. MCRT refers to the average number of days that a “cell” remains in an activated sludge system.

# 178 Chapter 11. Activated Sludge

\*a. True

b. False

1. MCRT refers to the average number of days that a “cell” remains in an activated sludge system.

\*a. True

b. False

1. In activated sludge treatment a young sludge age is marked by a low F:M ratio
   1. True

\*b. False

1. The "M" in the F:M ratio is the mass of mixed liquor suspended solids in the aeration basin
   1. True

\*b. False

1. The SVI test is used for establishing amount of sludge to be wasted
   1. True

\*b. False

1. SVI test is conducted using an Imhoff cone
   1. True

\*b. False

1. A WAS or RAS flow change of 25% in one day will have little impact on the activated sludge treatment process
   1. True

\*b. False

1. Activated sludge is an anaerobic process
   1. True

\*b. False

1. Secondary treatment is mainly to remove the organic content of the wastewater

\*a. True

b. False

1. Excessive filamentous bacteria in activated sludge is typically controlled by bleach addition to RAS

\*a. True

b. False

1. Rotifers are the dominant microorganisms in a young activated sludge
   1. True

\*b. False

1. Secondary treatment is mainly to remove the organic content of the wastewater

\*a. True

b. False

1. SVI is a measure of the sludge volume that needs to be wasted
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## 11.6 Process modifications 179

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1. The F in the F to M ratio refers to the pounds of mixed liquor volatile suspended solids under aeration in an activated sludge plant.
   1. True

\*b. False

1. The use of F:M ratio for controlling the activated sludge process implies the need for higher mass of microorganisms to treat a stream with a higher BOD

\*a. True

b. False

1. The white billowing foam commonly seen during the startup of the activated sludge plant is caused by low F:M ratio
   1. True

\*b. False

1. When an activated sludge plant is first started, one should expect to see foaming

\*a. True

b. False

1. Activated sludge is an anaerobic process
   1. True

\*b. False

1. A WAS or RAS flow change of 25% in one day will have little impact on the activated sludge treatment process
   1. True

\*b. False

1. Bulking is caused by excessive filamentous bacteria

\*a. True

b. False

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\*b. False

1. In conventional secondary wastewater treatment processes, aerobic decomposition of solids will occur.

\*a. True

b. False

1. In the activated sludge process, the wastewater oxygen demand may be separated into two cate- gories: carbonaceous and nitrogenous

# 180 Chapter 11. Activated Sludge

\*a. True

b. False

1. MCRT refers to the average number of days that a “cell” remains in an activated sludge system.

\*a. True

b. False

1. A WAS or RAS flow change of 25% in one day will have little impact on the activated sludge treatment process
   1. True

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1. The abundance of rotifers in the activated sludge is generally the cause of “bulking”
   1. True

\*b. False

1. The F in the F to M ratio refers to the pounds of mixed liquor volatile suspended solids under aeration in an activated sludge plant.
   1. True

\*b. False

1. The use of F:M ratio for controlling the activated sludge process implies the need for higher mass of microorganisms to treat a stream with a higher BOD

\*a. True

## 11.6 Process modifications 181

b. False

1. The white billowing foam commonly seen during the startup of the activated sludge plant is caused by low F:M ratio
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1. When an activated sludge plant is first started, one should expect to see foaming

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1. A consulting engineer has recommended addition of a roughing filter and intermediate clarifier between your primary clarifier and aeration basin to better handle increasing industrial loads. This addition would:
   1. Be the best form of flow equalization available
   2. Remove most of the fixed dissolved solids
   3. Reduce drastically the fine dissolved matter
   4. Cost a lot and do nothing

\*e. Reduce the organic load on the aeration basin

1. MLVSS represents the fraction of the MLSS
2. Optimal range of SVI is between
3. Straggler floc is associated with [ sludge while pin-floc is associated with

sludge

1. Bulking and foaming is due to bacteria
2. Portion of the activated sludge floc settled in the clarifier that is returned to the front of the aeration basin to seed the incoming primary effluent is called [name]
3. What is the purpose of a clarifier?
   1. Aerate the primary effluent

\*b. Allow for the solids to settle

1. To disinfect the secondary effluent
2. To remove the inorganic solids
3. The four (4) basic components of every activated sludge treatment system are:
   1. Primary treatment, secondary treatment, clarification and disinfection
   2. Pre-treatment, aeration, clarification and disinfection

\*c. Aeration, clarification, return sludge and waste sludge

d. Pre-treatment, primary treatment, secondary treatment and disinfection

1. The basic objective in the activated sludge process is to maintain balanced conditions in the aera- tion basin, this balance is called:
   1. Endogenous respiration

\*b. Food/microorganism ratio

1. Equilibrium status
2. Mass balance ratio
3. The volume of settled sludge in the 30 minute settleability (ml/l) times 1000, divided by the MLSS concentration is called:

\*a. Sludge Volume Index

1. Sludge Age
2. Sludge Mass Ratio
3. Mean Cell Residence Time

# 182 Chapter 11. Activated Sludge

1. In the activated sludge treatment process, there are several control methods. One method is to maintain a BOD:MLVSS ratio. This is commonly referred to as:
   1. MCRT.
   2. SA.
   3. SA:SDI.

\*d. F:M.

e. TS:SRT

1. The 1-liter graduated cylinder is used to measure the volume concentration of settleable solids.
   1. clarity of sludge supernatant.
   2. suspended solids concentration in mg/L.

\*c. 30-minute mixed liquor sludge settleability.

d. the sludge volume index in g/L

1. In calculating the detention time in an aeration tank, which one factor would not be considered?
   1. tank volume
   2. RAS flow
   3. plant flow

\*d. MLSS concentration

e. none of the above

1. The BOD loading rate divided by the quantity of microorganisms present in the biological reactors (aeration tanks) is known as:
   1. organic loading
   2. toxicity
   3. hydraulic loading

\*d. food to microorganism ration F:M

1. Sludge wasting from secondary clarifiers, are normally required in order to control
   1. Effluent BOD.
   2. Effluent suspended solids.
   3. Aerator mixed liquor solids.

\*d. Sludge settleability

1. An activated sludge process that has a desired F/M ratio of 0.05 and a sludge age of 30 days is what type of activated sludge process modification?

\*a. Extended aeration

1. Conventional
2. Complete mix
3. Oxidation ditch
4. Two major operational difficulties which sometimes occur in activated sludge secondary clarifiers are:

\*a. Low D.O. and algae growth

1. Short circuiting and scum accumulation
2. Rising sludge and bulking sludge
3. Long detention time and short MCRT.
4. A thick, scummy, dark tan foam on the surface of an activated sludge aeration tank is an indication of:

\*a. Aeration tank is underloaded (high MLSS.

1. Aeration tank is overloaded (low MLSS.

## 11.6 Process modifications 183

1. Excess grease in raw wastewater
2. Excess phosphates (detergents. in raw wastewater
3. The four (4) basic components of every activated sludge treatment system are:
   1. Primary treatment, secondary treatment, clarification and disinfection
   2. Pre-treatment, aeration, clarification and disinfection

\*c. Aeration, clarification, return sludge and waste sludge

d. Pre-treatment, primary treatment, secondary treatment and disinfection

1. The basic objective in the activated sludge process is to maintain balanced conditions in the aera- tion basin, this balance is called:
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   3. plant flow

\*d. MLSS concentration

e. none of the above

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   1. organic loading
   2. toxicity
   3. hydraulic loading

\*d. food to microorganism ration F:M

1. Sludge wasting from secondary clarifiers, are normally required in order to control
   1. Effluent BOD.

# 184 Chapter 11. Activated Sludge

* 1. Effluent suspended solids.
  2. Aerator mixed liquor solids.

\*d. Sludge settleability

1. In calculating the detention time in an aeration tank, which one factor would not be considered?
   1. tank volume
   2. RAS flow
   3. plant flow

\*d. MLSS concentration

e. none of the above

1. In calculating the detention time in an aeration tank, which one factor would not be considered?
   1. tank volume
   2. RAS flow
   3. plant flow

\*d. MLSS concentration

e. none of the above

1. A good quality of activated sludge is shown by:
   1. Black color and very small particle size
   2. Finely dispersed milky white particles
   3. A chocolate brown MLSS that does not settle well in the jar test
   4. A sludge that settles in one minute in the jar test

\*e. A chocolate color which settles out in 20-30 minutes with a D.O. of 2.0

1. An activated sludge process that has a desired F/M ratio of 0.05 and a sludge age of 30 days is what type of activated sludge process modification?

\*a. Extended aeration

1. Conventional
2. Complete mix
3. Oxidation ditch
4. An aerobic treatment process is one that requires the presence of:
   1. Ozone
   2. organic oxygen
   3. no oxygen
   4. combined oxygen

\*e. dissolved oxygen

1. An increasing F/M ratio and decreasing MCRT indicates

\*a. Excessive solids wasting causing a decrease in solids inventory

1. Inadequate solids wasting causing an increase in the solids inventory
2. Decreased hydraulic load increasing the sludge detention time
3. Operation is normal
4. A rapid and significant increase in filamentous organisms in the mixed liquor may be expected to:
   1. Result in a far better effluent because of the great amount of surface area for absorption
   2. Plug up the return sludge pumps because the filaments hang upon valves and gaskets in the sludge line
   3. Lead to much denser return sludge because the filaments would tend to strain the dispersed cells of ordinary organisms out of the effluent

\*d. Cause bulking of the sludge solids to the point that some solids might be swept out along with

## 11.6 Process modifications 185

an otherwise clear liquid phase and result in turbid, poor quality effluent

e. Lead to a much lower F/M ratio because the filaments are so totally insoluble.

1. A rapid and significant increase in filamentous organisms in the mixed liquor may be expected to:
   1. Result in a far better effluent because of the great amount of surface area for absorption
   2. Plug up the return sludge pumps because the filaments hang upon valves and gaskets in the sludge line
   3. Lead to much denser return sludge because the filaments would tend to strain the dispersed cells of ordinary organisms out of the effluent

\*d. Cause bulking of the sludge solids to the point that some solids might be swept out along with an otherwise clear liquid phase and result in turbid, poor quality effluent

e. Lead to a much lower F/M ratio because the filaments are so totally insoluble.

1. In the activated sludge treatment process, there are many control methods. One method is to main- tain a constant BODs:MLVSS ratio. sludge treatment process. This is commonly referred to as:
   1. MCRT
   2. SA
   3. SA: SDI

\*d. F:M

e. TS:SRT

1. The SVI of activated sludge is defined as:
   1. the volume of settled mixed liquor after 30 minutes or settling·
   2. the weight in grams of 200 ml of settled activated sludge

\*c. the volume in ml of 1 gram of activated sludge after 30 minutes of settling

1. the total volume of MLSS in the aeration tank
2. the volume of settled sludge in the secondary clarifier
3. The amount of air required in the operation of an activated sludge aeration tank is independent of the:
   1. temperature
   2. flow
   3. detention time
   4. organic loading

\*e. none of the above

1. The successful operation of an activated sludge plant requires the maintenance of proper solids concentration in the system. One major limiting factor is:
   1. mixed liquor tank volume
   2. effluent flow

\*c. air supply

1. chlorine demand
2. none of the above
3. The main difference between primary and secondary clarifiers is the:
   1. overall dimensions
   2. type of outlet weirs

\*c. density of sludge

1. detention period
2. flow distribution
3. Given the data below, what is the most likely cause of the extended aeration facility problem?

# 186 Chapter 11. Activated Sludge

DATA: DO level high Blower normal

Wastewater characteristics normal Drop pipe air control valves open Surface turbulence high

a. Air relief valve stuck shut

\*b. Blower speed too fast

c. Blower speed too slow

d. Drop pipe air control valves not open far enough

1. What test is used to determine the organic matter found in the mixed liquor?
   1. COD
   2. MLSS

\*c. MLVSS

d. TOC

1. Fixed porous plate diffusers can be cleaned by scrubbing with
   1. Detergent
   2. A strong acid solution

\*c. A strong chlorine solution

d. A weak sodium hydroxide solution

1. Given the following data, what is the most likely cause of the activated sludge problem? DATA:

The aeration tanks in an activated sludge plant have maintained a stable white foam with a brown- ish tint less than one inch thick

BOD removals have been at their normal high efficiency Settling of the activated sludge in the secondary clarifiers has been good - as is normal

Air supplied to the system has been a normal 30,000 cfm, with a consistent DO of 25 mg/L MLSS has been maintained at 2,500 mg/L - normal

Gradually during your shift the DO has risen to 50 mg/L

* 1. A toxic substance has affected the activated sludge
  2. BOD loading on the aeration system has increased.
  3. Increased BOD loading has caused a corresponding increase in activated sludge activity

\*d. No change

1. Sludge wasting from secondary clarifiers, are normally required in order to control
   1. Effluent BOD.
   2. Effluent suspended solids.
   3. Aerator mixed liquor solids.

\*d. Sludge settleability

1. The four (4) basic components of every activated sludge treatment system are:
   1. Primary treatment, secondary treatment, clarification and disinfection
   2. Pre-treatment, aeration, clarification and disinfection

\*c. Aeration, clarification, return sludge and waste sludge

d. Pre-treatment, primary treatment, secondary treatment and disinfection

1. The basic objective in the activated sludge process is to maintain balanced conditions in the aera- tion basin, this balance is called:

## 11.6 Process modifications 187

1. Endogenous respiration

\*b. Food/microorganism ratio

1. Equilibrium status
2. Mass balance ratio
3. A 30 minute settleability test MLSS sample should be collected:
   1. At the primary clarifier effluent
   2. In the return sludge line
   3. Where the return sludge mixes with the aeration basin contents
   4. At the aeration basin influent

\*e. At the aeration basin outlet

1. A consulting engineer has recommended addition of a roughing filter and intermediate clarifier between your primary clarifier and aeration basin to better handle increasing industrial loads. This addition would:
   1. Be the best form of flow equalization available
   2. Remove most of the fixed dissolved solids
   3. Reduce drastically the fine dissolved matter
   4. Cost a lot and do nothing

\*e. Reduce the organic load on the aeration basin

1. What is the purpose of a clarifier?
   1. Aerate the primary effluent

\*b. Allow for the solids to settle

1. To disinfect the secondary effluent
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   1. Endogenous respiration

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1. Equilibrium status
2. Mass balance ratio
3. The volume of settled sludge in the 30 minute settleability (ml/l) times 1000, divided by the MLSS concentration is called:

\*a. Sludge Volume Index

1. Sludge Age
2. Sludge Mass Ratio
3. Mean Cell Residence Time
4. The most important adjustments to the activated sludge process are made by adjusting
   1. Aeration, pH and RAS
   2. Aeration, pH and WAS

\*c. RAS, WAS and aeration

d. pH, RAS and WAS

# 188 Chapter 11. Activated Sludge

1. In the activated sludge treatment process, there are several control methods. One method is to maintain a BOD:MLVSS ratio. This is commonly referred to as:
   1. MCRT.
   2. SA.
   3. SA:SDI.

\*d. F:M.

e. TS:SRT

The 1-liter graduated cylinder is used to measure the volume concentration of settleable solids.

1. clarity of sludge supernatant.
2. suspended solids concentration in mg/L.

\*c. 30-minute mixed liquor sludge settleability.

d. the sludge volume index in g/L

1. In calculating the detention time in an aeration tank, which one factor would not be considered?
   1. tank volume
   2. RAS flow
   3. plant flow

\*d. MLSS concentration

e. none of the above

1. The BOD loading rate divided by the quantity of microorganisms present in the biological reactors (aeration tanks) is known as:
   1. organic loading
   2. toxicity
   3. hydraulic loading

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1. An activated sludge process that has a desired F/M ratio of 0.05 and a sludge age of 30 days is what type of activated sludge process modification?

\*a. Extended aeration

1. Conventional
2. Complete mix
3. Oxidation ditch
4. An activated sludge process that has a desired F/M ratio of 0.05 and a sludge age of 30 days is what type of activated sludge process modification?

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4. Two major operational difficulties which sometimes occur in activated sludge secondary clarifiers are:

\*a. Low D.O. and algae growth

1. Short circuiting and scum accumulation

## 11.6 Process modifications 189

1. Rising sludge and bulking sludge
2. Long detention time and short MCRT.
3. Two major operational difficulties which sometimes occur in activated sludge secondary clarifiers are:

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1. Short circuiting and scum accumulation
2. Rising sludge and bulking sludge
3. Long detention time and short MCRT.
4. The four (4) basic components of every activated sludge treatment system are:
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# 190 Chapter 11. Activated Sludge

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   2. RAS flow
   3. plant flow

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e. none of the above

1. Possible techniques for controlling filamentous organisms in an activated sludge process include:

\*a. Dosage of return sludge with a disinfectant such as chlorine or hypochlorite

1. Lower DO levels in aeration bans so filamentous organisms cannot breathe or respire
2. Lower F/M level to starve filamentous organisms
3. Stop wasting to allow activated sludge bugs to gain control
4. Possible techniques for controlling filamentous organisms in an activated sludge process include:

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4. An aerobic treatment process is one that requires the presence of:
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   2. organic oxygen
   3. no oxygen
   4. combined oxygen

\*e. dissolved oxygen

1. An increasing F/M ratio and decreasing MCRT indicates

\*a. Excessive solids wasting causing a decrease in solids inventory

1. Inadequate solids wasting causing an increase in the solids inventory
2. Decreased hydraulic load increasing the sludge detention time
3. Operation is normal
4. A rapid and significant increase in filamentous organisms in the mixed liquor may be expected to:
   1. Result in a far better effluent because of the great amount of surface area for absorption
   2. Plug up the return sludge pumps because the filaments hang upon valves and gaskets in the

## 11.6 Process modifications 191

sludge line

* 1. Lead to much denser return sludge because the filaments would tend to strain the dispersed cells of ordinary organisms out of the effluent

\*d. Cause bulking of the sludge solids to the point that some solids might be swept out along with an otherwise clear liquid phase and result in turbid, poor quality effluent

e. Lead to a much lower F/M ratio because the filaments are so totally insoluble.

1. A thick, scummy, dark tan foam on the surface of an activated sludge aeration tank is an indication of:

\*a. Aeration tank is underloaded (high MLSS.

1. Aeration tank is overloaded (low MLSS.
2. Excess grease in raw wastewater
3. Excess phosphates (detergents. in raw wastewater
4. During severe cold weather operation of an activated sludge plant biological activity and clarifier sludge settling is reduced. White of the following might help?

\*a. Increase the MLSS

1. Decrease the MLSS
2. Increase the D.0.
3. Decrease the D.0.
4. Add ammonia
5. Excess white foam in an aeration basin can be corrected by
   1. Decreasing the aeration rate
   2. Decreasing detention time

\*c. Increasing the MLSS

1. Decreasing the MLSS
2. Increasing aeration rate
3. Given the following data, what is the most likely cause of the activated sludge problem?

DATA: The aeration tanks in an activated sludge plant have maintained a stable white foam with a brownish tint less than one inch thick. ·

BOD removals have been at their normal high efficiency.

Settling of the activated sludge in the secondary clarifiers has been good - as is normal.

Air supplied to the system has been a normal 30,000 cfm, with a consistent DO of 2.5 mg/L. MLSS has been maintained at 2,500 mg/L - normal.

Gradually during your shift the DO has risen to 5.0 mg/L.

* 1. A toxic substance has affected the activated sludge.
  2. BOD loading on the aeration system has increased.
  3. Increased BOD loading has caused a corresponding increase in activated sludge activity.

\*d. No change.

1. Given the following data, what is the most likely cause of the secondary sedimentation tank prob- lem?

DATA: Sludge depth in tank too high. Tank effluent turbid.

Tank effluent requiring above normal chlorine dosage. Sweeparms in tank bottom operating. Return activated sludge flow to aeration tank low.

Controls on return activated sludge pump on automatic. Control sensors for return sludge operating normally.

# 192 Chapter 11. Activated Sludge

1. Accuracy of sludge depth measurement.
2. Return activated sludge pump worn, needing repair.

\*c. Speed of sweeparms travel.

d. Sweep arm overload tripped.

1. How many gallons of paint will be required to paint the walls of a 40 ft long x 65 ft wide x 20 ft high tank if the paint coverage is 150 sq. ft per gallon. Note: We are painting walls only. Disregard the floor and roof areas.

\*a. 28 gallons

1. 63 gallons
2. 35 gallons
3. 56 gallons
4. If there is an insufficient supply of air or oxygen being introduced into the aeration tank of an extended aeration plant, the liquid in the tank will likely
   1. Contain a very fine light brown floc.
   2. Contain very small air bubbles.

\*c. Have a black or blackish appearance and an offensive odor.

d. Have a dishwater appearance and a greasy odor.

1. If the return sludge pump does not function the effect on other unit processes will be to:
   1. Tum the aeration basin influent dark
   2. Increase chlorine residual

\*c. Increase effluent suspended solids

1. All the above
2. None of the above.
3. If the sludge depth in a secondary sedimentation tank is too high, what will happen?
   1. Decreased turbidity in effluent.
   2. Return activated sludge will have lower oxygen demand.
   3. Settleable solids from aeration tank will increase.

\*d. Sludge may become septic.

1. If you must waste sludge from an activated sludge plant the maximum rate is:

\*a. 20 % per day

1. 40 % per day
2. 60 % per day
3. 75% per day
4. 100 % perday
5. In an activated sludge system, what is perhaps the most important parameter affecting biological activity?
   1. pH.
   2. Alkalinity.

\*c. Dissolved oxygen.

d. Temperature.

1. In calculating the detention time in an aeration tank, which one factor would not be considered?
   1. tank volume
   2. RAS flow
   3. plant flow

\*d. MLSS concentration

## 11.6 Process modifications 193

e. none of the above

1. In the activated sludge treatment process, there are several control methods. One method is to maintain a BOD:MLVSS ratio. This is commonly referred to as:
   1. MCRT.
   2. SA.
   3. SA:SDI.

\*d. F:M.

e. TS:SRT

Mean cell residence time (MCRT. represents the theoretical time that a microorganism stays in the activated sludge system. The typical values for most activated sludge processes are:

1. 3 - 30 days

\*b. 3 - 15 days

1. 5 - 15 days
2. 5 - 20 days
3. Nocardia is associated with a particular type of brown, viscous scum or foam on the surface of the activated sludge aeration tank. One operational strategy that has been somewhat successful in reducing the severity of this foam is:
   1. to increase the plant’s MCRT.

\*b. to decrease the plant’s mixed liquor concentration.

1. to operate at an F:M ratio of less than 0.025.
2. to spray the foam with fine mist water sprays.
3. to increase the luxury DO concentration at the end of the aeration tank.
4. One limitation in using constant mixed liquor volatile suspended solids (MLVSS) or mixed liquor total suspended solids (MLTSS) as the control methodology for activated sludge treatment is

\*a. In practice it is not possible to operate at a constant MLTSS or MLVSS.

1. It is based on consistency of raw waste load which seldom exists.
2. Most facilities don’t have the lab equipment necessary to determine MLVSS.
3. None of the above.
4. One limitation in using constant mixed liquor volatile suspended solids (MLVSS) or mixed liquor total suspended solids (MLTSS) as the control methodology for activated sludge treatment is

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