**Activated Sludge Microbiology Quiz**

**Introduction:**

This quiz is designed to test your knowledge of activated sludge microbiology, covering common problems in activated sludge systems, their causes, and effective control methods. The questions are based on information presented in the provided document.

**I. Multiple Choice**

1. Which of the following is a common cause of dispersed growth in activated sludge systems treating industrial waste? a) Low F/M ratio b) High F/M ratio c) Low nutrient levels d) High MLSS concentration
2. What is the primary component of the extracellular "slime" layer that aids in floc formation? a) Lipids b) Proteins c) Polysaccharides d) Cellulose
3. Which of the following conditions favors floc formation in activated sludge systems? a) High growth rates b) Low nutrient levels c) High organic loading d) High F/M ratio
4. What is the most common operational adjustment to correct dispersed growth problems? a) Decrease aeration b) Increase F/M ratio c) Raise MLSS concentration d) Lower RAS rate
5. Which of the following is a characteristic of pin floc? a) Large, strong flocs b) Flocs with a filament backbone c) Small, weak flocs d) High settling rate
6. Which of the following can cause a pin floc condition? a) High F/M b) Chronic toxicity c) High nutrient levels d) High pH
7. What is an early microscopic sign of toxicity in activated sludge? a) Increase in floc size b) Initial flagellate "bloom" c) Proliferation of filamentous bacteria d) Decrease in respiration rate
8. What does the OUR test measure? a) Total suspended solids b) Biochemical oxygen demand c) Oxygen uptake rate d) pH
9. At what pH is hydrogen sulfide toxicity the highest? a) Above 8 b) 7 or less c) Around 7.5 d) pH is not a factor in sulfide toxicity
10. Which of the following is a consequence of nitrification in activated sludge systems? a) Increased alkalinity b) Decreased effluent turbidity c) Loss of chlorine disinfection d) Increased pH
11. What causes sludge blanket flotation in the final clarifier? a) High pH b) High DO c) Denitrification d) Nitrification
12. How can denitrification be controlled? a) Reducing aeration b) Increasing sludge age c) Increasing RAS rates d) Decreasing the DO concentration
13. What is the recommended range for effluent total inorganic nitrogen to prevent nutrient deficiency? a) 5-10 mg/L b) 1-2 mg/L c) 10-20 mg/L d) 0.1-0.5 mg/L

14. Which of the following is a sign of nutrient deficiency in activated sludge? a) Low sludge viscosity b) Low polysaccharide content c) Filamentous bulking d) Low foam production
15. Which organism is primarily associated with zoogloeal bulking? a) *Nocardia amarae* b) *Microthrix parvicella* c) *Zoogloea ramigera* d) *Sphaerotilus natans*
16. High amounts of which of the following can cause zoogloeal bulking? a) Nitrate b) Organic acids c) Polysaccharides d) Lipids
17. What is the primary operational definition of a bulking sludge? a) High MLSS b) Low SVI c) High SVI d) High OUR
18. What is the negative impact of a bulking sludge? a) Improved effluent quality b) Increased sludge settling rate c) Loss of sludge inventory d) Reduced disinfection costs
19. Approximately how many different filamentous bacteria commonly occur in activated sludge? a) 5 b) 10 c) 25 d) 50
20. Which of the following filaments is associated with low dissolved oxygen? a) *Nocardia spp.* b) *Microthrix parvicella* c) *Sphaerotilus natans* d) *Type 0041*
21. Which of the following filaments is associated with septicity? a) *Type 0041* b) *Type 0675* c) *Thiothrix I and II* d) *Haliscomenobacter hydrossis*
22. Which of the following filaments is associated with grease and oil? a) *Sphaerotilus natans* b) *Nocardia spp.* c) *Type 0041* d) *Type 021N*
23. Which of the following filaments is associated with nutrient deficiency? a) *Type 0041* b) *Nocardia spp.* c) *Thiothrix I and II* d) *Sphaerotilus natans*
24. Which of the following filaments is associated with low F/M? a) *Type 0041* b) *Nocardia spp.* c) *Thiothrix I and II* d) *Sphaerotilus natans*
25. Which of the following filaments can cause foaming? a) *Sphaerotilus natans* b) *Nocardia spp.* c) *Type 0041* d) *Thiothrix I and II*

**II. True/False**

26. A high F/M ratio can lead to dispersed growth.
27. Pin floc contains a filament backbone.
28. Hydrogen sulfide toxicity is independent of pH.
29. Nitrification can cause a decrease in pH.
30. Denitrification releases nitrogen gas.
31. Nutrient deficiency can lead to polysaccharide bulking.
32. *Zoogloea ramigera* is a filamentous organism.
33. A high SVI indicates good sludge settling.
34. Filamentous bacteria are always detrimental to activated sludge.
35. Chlorination is a long-term solution for filamentous bulking.
36. Increasing MLSS can help control low DO filaments.
37. Septicity is characterized by high organic acid and sulfide concentrations.

38. Low F/M conditions favor the growth of some filamentous bacteria.
39. Selectors are used to create a short-term, low-substrate condition.
40. Nutrient deficiency is more common in domestic wastewater.
41. *Nocardia* foaming is stabilized by interlocking filaments.
42. Chemical antifoam agents are effective against *Nocardia* foams.

**III. Fill-in-the-Blank**

43. The real "heart" of the activated sludge system is the development and maintenance of a mixed ____ culture.
44. ____ is the term for small, weak flocs in activated sludge.
45. The OUR test is used to detect ____ early.
46. ____ has a significant chlorine demand.
47. ____ bulking is caused by the overproduction of extracellular polysaccharide.
48. A sludge with an SVI of >____ ml/g is often considered a bulking sludge.

**Answer Key**

**I. Multiple Choice**

1. b
2. c
3. b
4. c
5. c
6. b
7. b
8. c
9. b
10. c
11. c
12. c
13. b
14. c
15. c
16. b
17. c
18. c
19. c
20. c
21. c
22. b

23. c
24. a
25. b

## II. True/False

26. True
27. False
28. False
29. True
30. True
31. True
32. False
33. False
34. False
35. False
36. True
37. True
38. True
39. False
40. False
41. True
42. False

## III. Fill-in-the-Blank

43. microbial
44. Pin floc
45. toxicity
46. Nitrite
47. Slime
48. 150