May '07 Volume 4.5

The Wastewater Insight

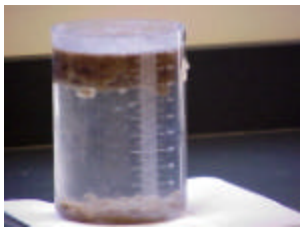
SECONDARY CLARIFIERS

Secondary Clarifiers

This is a main component in a wastewater treatment plant and often under valued. The purpose of the clarifier is two-fold. First of all it has to act as a thickener as well as a clarifier. Solids enter the clarifer and are settled so as to thicken up the solids, return some back to the head of the plant, and then to waste out some of the solids. The second purpose, obviously is while settling the solids, a clear supernatant should be produced and this is the final effluent. So yes, thickening and clarification are both important here.

Retention time
Solids removal
Return rates
Depth of Bed
Ashing and Gassing
Scum removal
TSS reduction
Algae
Short circuiting
Rust, corrosion and bent weirs
Chemicals

How long do I hold the solids in the clarifier? One good way to judge how long the solids can be held in your clarifier is to run a settleometer test. You cannot physically see into the bottom of the clarifier, so by using your settleometer, you are basically running a clarifier test. How long does it take for the solids to settle, how much of a bed is created, how much bulking, is there a rag layer, how long does it take for gassing? ashing? How long before the whole thing pops to the surface? These are all things you look at when running a settleometer. Do not just run it for the normal 30 minutes. Check to see how long it takes before there is small pin floc on the surface. Time it, check to see how long it takes for the whole bed to pop. These will give you an idea of how long you have in your clarifier before it will happen in your plant.



One thing that can be done is a dilute 50/50 test. In this test a normal settleometer is run, and then one with 50% water and 50% sludge run. This is used along with your microscope to tell if you just have too much MLSS or you have a case of filamentous bulking. If you have filamentous, and your sludge only settles to

MYSTERY BUG OF THE MONTH

We started this month out with a new

Mystery Bug of the month!

Check out our website for more photos of our new mystery bug!!!! WWW.EnvironmentalLeverage.com

900, then in a 50/50 dilute with just too much MLSS, theoretically, it should settle to around 450. It you have filamentous bulking though, it may settle in the 50/50 at 700 or 800, but definitely not at the halfway point.

Operators tend to think that all biological activity occurs only in the aeration basin. Wrong, it occurs all throughout your system. It is not a sterile environment. There will be biological activity even in your clarifier, especially if you still have some BOD left, otherwise there will be endogenous respiration. The rule of thumb is to have 1-2 ppm of DO in your residual leaving the aeration system. Not because it means you need more air in the aerated system, but so that you have enough air for respiration in the clarifier. Think about it, you probably are carrying at least 1/3 to 1/2 of your solids inventory in your clarifier. That is a lot of bacteria. They still require oxygen, especially your nitrifiers. If you starve them of

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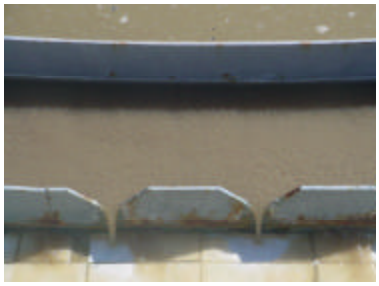
oxygen in the clarifier, and then return them back to the front of the system, it takes time for them to activate again. If you have more than enough oxygen in the clarifier, everything will settle, you will have clear supernatant, your bacteria will be ready to work the instant they are back in the aeration basin and you will not grow filaments.

How many solids should I have or how deep should the clarifier bed be?

That is a question that really should be looked at and determined by a mass balance and microscopic evaluation.

The amount of solids needed is based upon the type of plant you have, are you running , ie, extended air, do you have to achieve nitrification, biological nutrient removal. Are you a chemical plant or refinery with hard to degrade components? All of these variables determine how many bacteria you need in your system.

Remember, it is always a time and numbers game in a biological plant. How much time is determined by the size of the equipment, the numbers is determined by how much you return or use bioaugmentation to supplement the numbers.



Sludge age or the amount of solids needed should be determined by microscopic analyses instead of solids mass balance: Worms and rotifers with dark brown floc typically indicate an older sludge and take up less volume. Clear, light fluffy floc structures with tons of amoebae and flagellates indicate a younger sludge and this can take up more space physically. Tons of stalked ciliates and some free swimmers typically indicate medium age

sludge.

The problems with using Mathematical calculations typical of Engineers is that it does not really take into account the quality of the biomass, only the quantity. Filamentous sludge takes up more volume than floc forming bacteria. That will not help you determine if it is young or old. How many solids I need to have in my clarifier really depends upon the quality of that sludge and the age of the sludge my microscopic methods vs. math calculations. Use the microscope and determine by the higher life forms present whether you need to waste or return more solids.

A clarifier can only hold so many solids regardless of how many you

may actually need.

If you let the bed in the clarifier get too high, you will carryover solids into the final effluent. This will give you a high COD as well as TSS in the final effluent. You must control the amount of solids. Too high and it washes out, too low, and your pumps have problems with drawing down solids.

Check for rat holing, incomplete suction on the drawdown,

Ashing and Gassing what is this?

Gassing is the first sign that the bacteria are running our of air in the clarifier. You can call it an early warning system. Bacteria first will go for free oxygen, then nitrates, then sulfates. One way or another they will find a source. If you run out of air in the clarifier, and they have to use nitrates, they give off N2 gas. This will show up as gassing or air bubbles rising to the surface. Same with sulfates, H2S gas is generated, which if too high, can cause serious health problems.

Ashing is when tiny particles of floc trap that gas, and rise to the surface. Pay attention to those signs First you will see small tiny pin floc that looks like cigarette ash, then clumps

Then larger clumps finally the entire bed can burp and rise up.

Did you know that the solids that go over the weirs could impact your final effluent BOD results along with the TSS?

False high BOD readings can occur if biological material or algae are present in a BOD sample. These will increase the final BOD reading and potentially increase your final effluent values, which, in turn can mean permit violations or surcharge increases.

Did you know that algae on the clarifier weirs could increase your BOD?

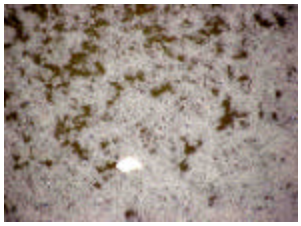
Algae typically grow on weirs during the warmer months. If the algae sloughs off and wind up in a final effluent bottle, they can give false TSS or high BOD readings, since the BOD test is run in the dark, the algae die, re-release their components and give a false reading. Small amounts of maintenance or regular cleaning can significantly impact the final effluent quality.

Do you know if you have short circuiting or solids build-up in your clarifier?

Well, if you have islands floating around in your clarifier, or plant growth, that is a sure sign that some changes need to be made.



Grease and oil should never be present on the surface of your clarifier. That means you did not have the right amount of bacteria, time and treatment in your aeration basin.




Temperature can change activity in your system.

Remember for every 10-degree F there is one logs growth of activity. Often times many plants hold a larger inventory in the winter since the bacterial activity slows down. More bacteria are needed to do the same amount of work. The problem is in the spring, very high temperature days can significantly increase biological activity. Too many bacteria can then cause growth of filaments. In the spring and fall months, with wide temperature swings, you may need to check your solids and adjust a slight amount daily based upon the temperatures. It is a whole lot easier to make small adjustments, than to grow filaments, increase the amount of dewatering costs, increase TSS in the final effluent or violate.

Scum removal, pits, troughs and RAS

Where does your scum go when it is removed from your clarifier? Basically it is bacteria that are dead or dying. Many plants unfortunately return the scum to the front of the plant. If it is dead, why not just get it out of the system? Dewater it ASAP and send it away.

Some plants have scum troughs that the scum is collected in. It sits in these troughs and gets in even worse condition. Unfortunately, we have even then seen this dead material mixed with RAS and returned to the front. Septicity, filaments, fungi can all increase in these pits.

What does your centerwell look like? Since this is where the solids have contact, there should not be scum, floating solids, or even plants growing in the centerwell. If need be use sprays and the force of the water to knock down any floating solids.

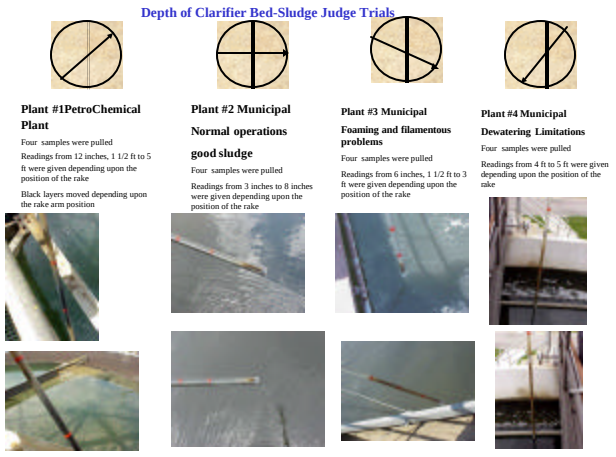
A sludge judge again is a must with a clarifier. Use of the sludge judge






should be standardized so that all operators use it at the same time, and at the same location of the weirs. The sludge judge can be a good visual of what is going on under the surface of the clarifiers. Are you rat holing, is the bed floating, does it have black spots, what does the rag layer look like?

Periodically, check all around the clarfier. Use the sludge judge vs. hiring a diver.



Bent Weirs, rust and corrosion that can break off and cause toxicity issues in final effluent testing with Flathead minnows or Rainbow trout more than with Daphnia.

Chemicals in clarifiers

Various chemicals can be used in clarifiers. Polymers sometimes are used during startups to help with settling or in under designed plants with young fluffy sludge that needs help in settling. Make sure not to overdose. More is not better! We have seen a plant where the entire bed was one big rolling bed and could not make it through the drawdown pipes.

Some plants use chlorine, do not add the chlorine in the clarifier. This will kill your bacteria.

Some people try to use ferric or alum for phosphorus removal. If possible set up a separate tank. Adding these chemicals to a clarifier will not only create tons of light fluffy sludge, but it will take up volume in your clarifier, mix with your RAS, end up back in the front of the plant. All your F/M calculations will be off, since you will be carrying inventory of inorganic sludge as opposed to active biomass. You might wind up significantly changing the abilities of your system.

Mechanical equipment: Pumping, RAS lines, suction, drawdown tubes, rakes, these are all mechanical parts that must be kept in good working order in order for successful operations of the clarifier.

As you can see, there are quite a few things to think about with clarifiers. Many small details can add up to a big impact on the efficiency of your plant, how well you meet final effluent permits, as well as how much money it costs!

Misc. websites

Water and wastewater digital newsletter or print magazines, free subscription
https://subscribe.1105pubs.com/SUB/WT?WP=NEWFREE&TC=1

The world of Algae
http://www.botany.uwc.ac.za/algae/index.htm

Images of fresh water algae and Protozoa
http://www.keweenawalgae.mtu.edu/

Great Lakes Water photos and images
http://www.glerl.noaa.gov/seagrant/GLWL/GLWLife.html

Great Algae and cyanobacteria Image Gallery
http://www-cyanosite.bio.purdue.edu/images/images.html

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Many times we have suggested articles for the next months issues. Sometimes we change what we will be featuring based upon critical issues that surface during our contacts with our customers. We hope this does not inconvenience you. If you have a specific topic you are interested and do not want to wait to see if it shows up in our newsletters, call us direct. We do have over 20 gigabytes of information on file on every subject around on water and waste issues.

COMING IN THE NEXT MONTHS . . . . .

We are open for suggestions?