Environmental Leverage INC.

Turning Liabilities into Leverage

September 2010

The Wastewater Insight

The wastewater insight

MYSTERY BUG OF THE MONTH

We started this month out with a new

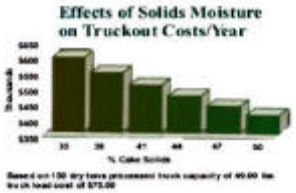
Mystery Bug of the month!

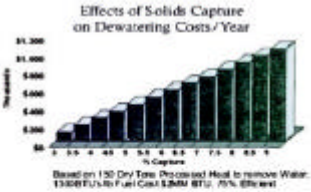
Check out our website for more photos of our new mystery bug!!!! WWW.EnvironmentalLeverage.com

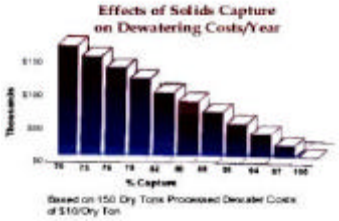
Inside this issue:

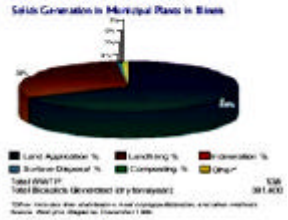
Solids handling- so many different things impact the cost to a WWTP

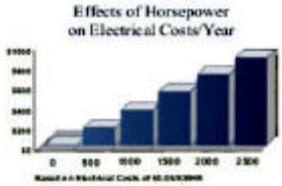
Some Typical Impacts on Improvements of Solids Generation

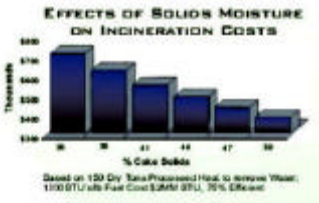












While electricity is usually the biggest cost at any wastewater treatment plant, solids handling can be the second biggest cost, sometimes as high as 30% or more.

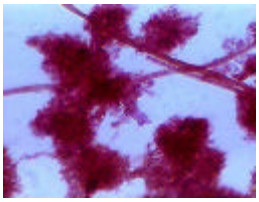
This is one area that can be significantly improved in many wastewater treatment plants and can allow for huge savings.

Solids generated at wastewater treatment plants can be very different, and may include primary sludge (settled solids from raw sewage or process waste at industries) and secondary sludge, which is organic, microbial mass loaded with nutrients or tertiary sludge such as alum or ferric to remove phosphorus at municipalities.

Each portion of that sludge has different characteristics.

Even secondary biological sludge can have different characteristics depending upon whether it is mostly floc formers, filamentous bacteria,

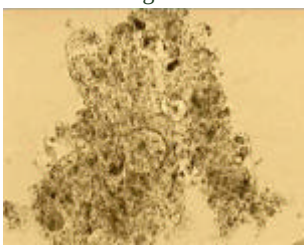
or zoogleal bacteria, or contains fiber, debris or carbon particles.



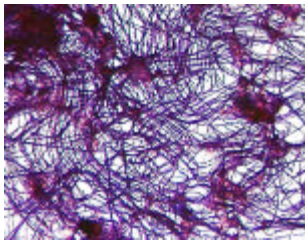
1000x Gram Stain

Imagine filamentous bacteria vs. floc formers. It is kind of like comparing meatballs to spaghetti. Filaments take up 3-4 times or more the space that floc formers do.

Both will degrade BOD, yet one will cost you more in solids handling. By optimizing the "Critical 5" and paying attention to your time and numbers you can promote floc formation instead of filamentous growth.



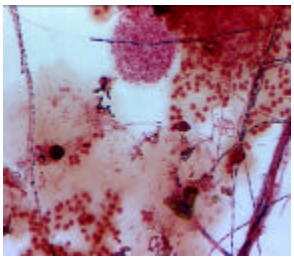
400x Bright Field



1000x Gram Stain

Notice on the left the floc is compact and abundant levels of bacteria fit in a very small compact space. Filaments on the other hand are a string of bacteria. They take up more space, which makes it hard to settle and dewater. They have pockets that collect air and make them float. The pockets also hold water like a sponge. This makes it harder to get dryer cake solids. Just by making sure you have the critical 5 taken care of all throughout your plant, you can start to control filaments and grow more floc formers. See Critical 5 newsletter.

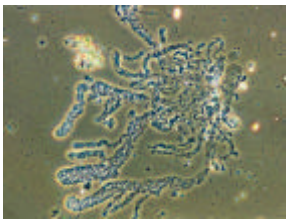
Use your microscope to find out what type of filament is present. If you know the filaments present, you can determine what the cause is, make a process change, and eliminate the filaments. Call our lab if you cannot determine the types of filaments present.



1000x Gram Stain

Now imagine if you have tons of Zooglea in your system. Picture taking a liter of polymer and pouring it onto your floc. What happens, you have a very slimy mess. That is what zoogleal bacteria are like.

Notice in the photo all the exopolymer that bacteria produce. You can visually see the amount compared to the size of the actual cell. These types of bacteria can turn an entire clarifier to jelly!



This type of bacteria is very hard to dewater. It will hold a lot of water, slime up your dewatering equipment, change polymer ratios required, and make very wet cake solids.

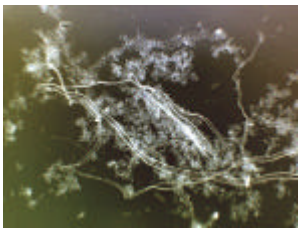
400x

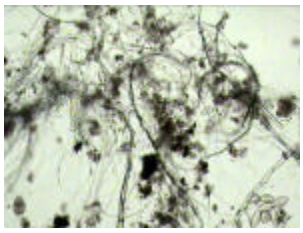
Many people then try to use chlorine in their wastewater treatment plant to get rid of this. **Do not use chlorine on Zooglea**. That will only make things worse and they will create more polysaccharide. Instead find out why you have Zooglea. They thrive on very young sludge, high BOD or nutrient deficiency systems. Check pH, if that is not the case then check N and P. Also check higher life forms. If you have very young sludge, decrease wasting and return a thicker RAS back to the front short term based upon influent loading and how large a spike of BOD you had at your plant. If you do not have the ability to do that, consider bioaugmentation for a short term to help even out the swings or for upset recovery.

Increase N or P based upon flow times loading. Remember for every 100 parts of carbon, you need 5 parts of ammonia and 1 part of phosphorus.

Notice the size difference

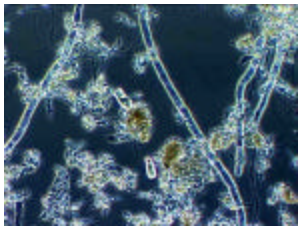
Algae and Fungi **100x** **Algae and Filaments**





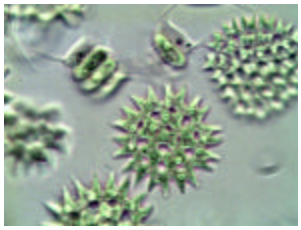
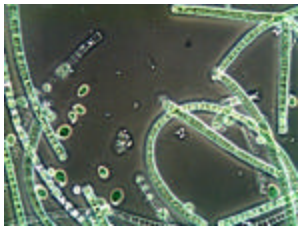
Fiber and Filaments **Fungi, Fiber and Filaments**

We said the floc formers are like a large compact meatball; filaments are like strings or make a sponge-like effect with the floc and take up space and hold water. Fiber and fungi are more like a steel wool pad. Very large compared to filaments. Bacteria will not degrade the fiber in the amount of time you have in your aeration basin. We took an 850,000 gal tank at a papermill filled with fiber and tried to remediate it to see how long bacteria would take to break down fibers. After three months of a large electricity bill, high N and P costs, we still had only broken down 30% of the fiber. It is cheaper and easier to physically remove the fiber. Make sure your screens are working. If need be, check for broken parts. If you are a municipality, fiber will come from the breakdown of tissue paper. Papermills obviously have a large amount of fiber. To them, it is a valuable byproduct. A 1% fiber recover can amount up to 1 million dollars in savings.



400x Bright field **100x Phase**

Fungi is another issue plants have when there are pH issues or septicity. This is the easiest to fix. Adjust pH to over 7 and they should disappear. Make sure you are not holding solids too long upstream, in primaries, digestors or clarifiers. Notice how large the fungi is compared to the floc formers.

1000x Bright field **100x Phase**

Algae is another issue that can impact solids handling as well as TSS. Algae can be small and free floating and that can impact TSS as well as BOD in the final effluent. Large stringy algae can impact floc settling just as easily as filaments or fungi and is larger than fungi. Algae is usually a sign that you need to clean your weirs on either primaries or secondary clarifier because technically your MLSS is too dense and sunlight cannot penetrate down into an aeration basin. Ponds may have algae also.


Automatic weir washers can easily help keep weirs cleaned

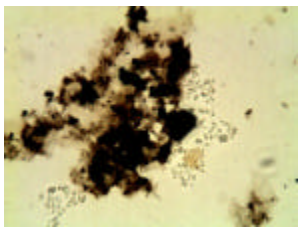
Inorganic sludge generation

Many municipalities are required to remove excess nutrients- N and P. Ammonia can be converted by nitrification. Excess phosphorus is usually chemically precipitated. Many plants use Alum, lime, or iron salts in the wastewater to remove phosphorus by sedimentation or clarification. This process can reduce the concentration of phosphate by more than 95 percent.

Some plants use lime or Ferric sulfate for pH adjustment and some plants use Ferric as a "micronutrient" addition.

The problems associated with the use of chemicals are their affinity to bind phosphorus. How much phosphorus is removed due to interaction with these chemicals, versus how much is needed by the bacteria as a nutrient source and how much interference the chemicals have on the impact of the biological process.

Very few plants have a tertiary clarifier for nutrient removal. Many plants add these chemicals directly to the secondary clarifier. The problem with this is over addition of chemicals that are returned in the RAS back to the front of the plant, causing an actual nutrient deficiency in the plant.



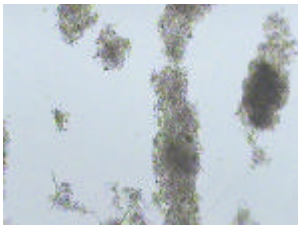
Each pound of liquid Alum produces 0.127 pounds of dry Aluminum sludge, with a slight variation depending on the Alum concentration.

Each pound of liquid of Ferric chloride produces 0.2677 pounds of dry iron oxide sludge, with the same slight variation.

Lime generates one pound of sludge per pound lime added.

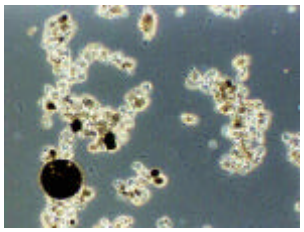
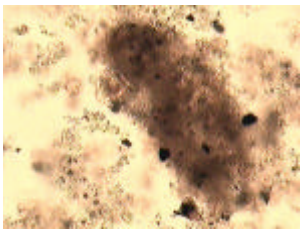
See newsletter on Lime vs. Ferric vs. Alum.

Inorganic lime or Alum crystals can be seen in Gram, Neisser and sometimes even bright field or phase.

Municipality with Ferric added at the front of the aeration basin **Irregular shaped floc 100x due to over addition of Ferric**

You can see how over addition of inorganic chemicals can impact your biomass and your solids handling costs.

100x Phase contrast Carbon particles **100x Bright field Carbon particles in a refinery- they add PAC- powdered activated carbon**

Some plants add PAC purposely to a plant. Some just have carbon, grit or debris coming in from the influent. Any type of solids that take up space in your system can impact solids handling. These solids are heavier, can easily settle out in dead spots or corners and can help create septicity.

Inorganic particles mixed in with the biomass usually tend to throw off MLSS, MCRT and other math calculations also. Use prescreening to make sure you remove these particles in your system.

You can see how different types of biology can make a huge difference on how your biomass reacts, settles, dewaters, as well as how much you spend on solids handling costs.

Next month we will go into pieces of equipment that you can optimize to help reduce solids handling costs.

Additional Links

"The photomicrographs from Environmental Leverage were of extremely high quality and the best available. The microorganisms were identified by Environmental Leverage with helpful background and contextual details."

"The organisms were captured in action and seem to come to life in the photographs."

Mark Ludwigson, P.E.

Project Engineer

www.biologyforeveryone.com
www.amazon.com/dp/0980832829

EPA Fact Sheets on various Biosolids Treatment Technologies

http://www.epa.gov/owm/mtb/alkaline_stabilization.pdf (lime stabilization)

http://www.epa.gov/owm/mtb/belt_filter.pdf (belt filter press)

http://www.epa.gov/owm/mtb/final_gravitythickening.pdf (gravity thickeners)

http://www.epa.gov/owm/mtb/centrifuge_thickening.pdf (centrifuges)

http://www.epa.gov/owm/mtb/invessel.pdf (in-vessel composting)

http://www.epa.gov/owm/mtb/recessed-plate.pdf (plate-and-frame press)

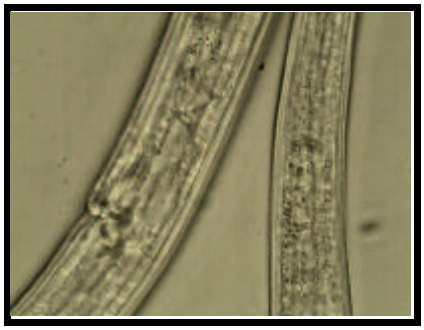
http://www.epa.gov/owm/mtb/combioman.pdf (composting)

http://www.epa.gov/owm/mtb/incineration_biosolids.pdf (incineration)

http://www.epa.gov/owm/mtb/landfilling_biosolids.pdf (landfilling)

http://www.werf.org/AM/Template.cfm?Section=Biosolids

Last Month's
MYSTERY BUG OF THE MONTH



Did you figure this out?

It was part of a nematode. What do nematodes mean? If they are common, it means you have a very old sludge and might want to consider wasting. If you have only one or two and see black spots in your mlss, it might mean you have solids build-up somewhere such as on weirs or in center wells in your clarifier. Check to make sure maintenance is not needed.

Mystery Bug of the month!

Check out our website for more photos of our new mystery bug!!!!
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Environmental Leverage
812 Dogwood Drive
North Aurora, IL 60542

Phone: 630-906-9791
Fax: 630-906-9792
E-mail: ELFEnvironmental@aol.com