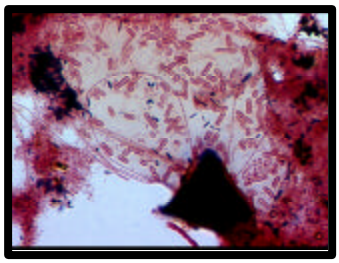
January '06 Volume 3.1

The Wastewater Insight

Environmental Leverage INC.

NUTRIENT DEFICIENCY



Are you under dosing nutrients at your plant?

Here is a scenario we come across occasionally in industrial facilities and occasionally at municipalities where they have industrial pre-treatment. Many industrial plants have to add N and P for the carbonaceous bacteria to consume as a nutrient source because there are insufficient levels in the process water.

Some times plants under dose the nitrogen feed. They see residuals in the final effluent, so they decrease the ammonia levels. The plant then gets a wide swing in loading and of course it becomes nutrient deficient. Under doses are often common in this scenario.

Typical dosing of nitrogen many times for a rule of thumb has been suggested that dosing of nutrients should be controlled so that there is a residual of 1-2 ppm in the final effluent. Part of the reason this rule of thumb guide is used is because final effluent residuals almost always have to be tested for permit levels. This saves on additional testing of influent parameters and the numbers are easily available.

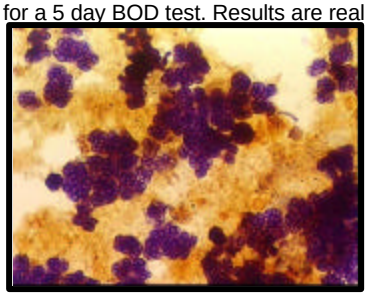
The problem with this scenario is that sometimes, plants are short on nutrients and create many problems in the system.

Another thing we see quite often at papermills or chemical plants that indicates this type of condition exists is the presence of tetrads. These little clusters of gram negative and Neisser positive cells almost always indicate nutrient deficiency. They can cause serious TSS problems. If you do, it means again, you are usually under dosing nitrogen. Increase your nitrogen dosing.

How do you figure out if you are dosing correctly? One simple test to run is N and P on the influent and effluent. If you do not have ammonia, or amines in the incoming process water, you should have to add sufficient nutrients so that you have a residual in the effluent levels.

Is there a quick way to test for this and make calculations-

Actually it is quite easy. You need to start feeding based upon front loading of carbon. There are now quick easy way to test TOC (total organic carbons) onsite in two hours. If you have testing equipment for COD, you can easily run TOC instead of COD or BOD. This is a better measure of the total carbons that bacteria will see as a food source than waiting for a 5 day BOD test. Results are real time and can be used for process control daily. Hach makes test N tube reagents that make it easy to run an onsite test for TOC. When you get the results, do the math calculation on N loading. As long as you do not have final effluent permits that are extremely low, typical loadings are 100-5-1 of Carbon-nitrogen to phosphorus.



You will then feed the bacteria the correct amount of nutrients instead of under dosing them and causing filaments or zooglea to grow in your plant. You might want to consider checking also into adding micronutrients if you constantly have BOD swings at your plant.

Another typical mistake plants make with nutrients is the time they dose their nutrients. Some plants slug feed

MYSTERY BUG OF THE MONTH

We started this month out with a new

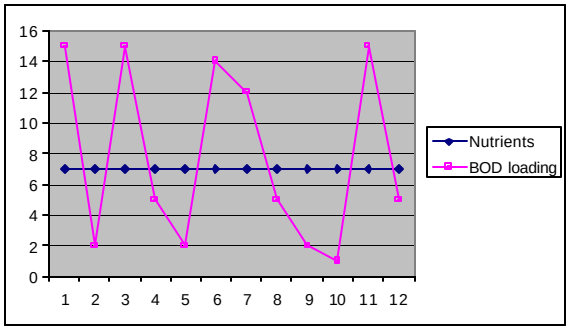
Mystery Bug of the month!

Check out our website for more photos of our new mystery bug, no it is not a tree!!!!
WWW.EnvironmentalLeverage.com

INSIDE

and some use a continuous feed rate. Make sure you are not slug feeding nutrients unless you get a huge slug of BOD. Typically the nutrients should be dosed according to the load. If the largest load is spread out during the day, then feed your nutrients continually. If you get huge swings at the end of the day when the plant shuts down or has high loading from clean-up processes, then increase during that loading period. Remember that the life span of the bacteria is 20 minutes to two hours. If you dose a ton in the morning, and they are not around until the evening, they will not see the nutrients you have loaded. You really need to feed nutrients based upon the influent loading. If your plant runs 24/7 and has continual consistent feed, a slow, continuous feed of nutrients is recommended. If, on the other hand, your plant runs only shifts, or tends to have batch dumps of high loadings, you need to slug feed your nutrients again based upon your feed loading.

A typical loading of nutrients is 100-5-1 of Carbon, to nitrogen to phosphorus in order for optimal bacterial growth. During wide swing loads, nutrients should be increased. Nutrient deficiency can cause serious problems. It is already harder for the floc forming bacteria to work when high organic instant BOD swings come through, but add the stress of nutrient deficiency and this increases the problems. This creates a climate that is difficult for the floc forming biomass to grow in, but enables filamentous bacteria to take over.



Think of it this way, if I gave you 5 hamburgers for breakfast, but nothing for lunch or dinner, you would be hungry by nighttime. Why, you had tons of food? It is the same with the bacteria. Think of this, many of the bacteria in the wastewater treatment plant have a life span of 20 minutes to 2 hours. If they are in the late shift, they never saw the nutrients that were loaded earlier.

Check your nutrients

Base loading on influent TOC

Adjust feed rate based upon influent loading

If necessary, test ammonia and phosphate at the influent and back end a few times to get a baseline and determine if overdosing or under dosing.

Most importantly, make sure the bacteria are getting the right amount of nutrients at the right time. Too much and you are wasting money and running the plant inefficiently, too little and you can get zooglea or filamentous bacteria problems and create worse problems!

But I am doing that and it still is a problem? Have you taken into the calculations from your supernatant off your digestor, belt press or sludge dewatering units? Many plants have digestors and sludge dewatering units. The supernatant off these units is returned to the front of the plant. This stream is almost always high in N and P. Run tests on this stream. Make a calculation on how many nutrients you are returning to the front of the system, and make sure to take that portion out of your math calculation when you are figuring out front loading dosing of nutrients. This is often a very important source of nutrients that is overlooked at many plants. Optimization of a plant's costs can be significant if this variable is considered.

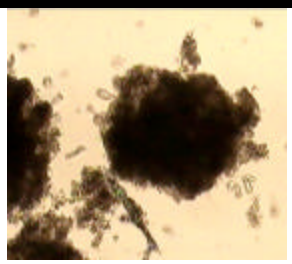
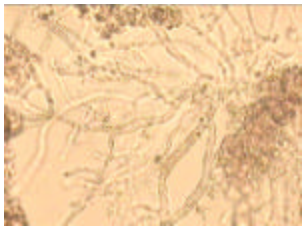
Do you have backwash water from a local drinking plant or final filter somewhere in the plant? Are you feeding ferric chloride or alum for some type of pH adjustment or metal precipitation? These all can seriously deplete any nutrients.

Ferric chloride can have a significant impact on the nutrient levels of phosphorus in a wastewater treatment plant if the levels are high enough. Ferric has a high affinity to pull out phosphorus. We were working with one wastewater treatment plant. They had signs of nutrient deficiency occasionally, which is usually rare for a municipality that does not have any industry or pretreatment dischargers. We noticed on one walkthrough of the plant that the primaries were bright red. We had them run levels on phosphorous on the primary effluent, aeration basin effluent and final clarifier. The ferric pulled out all of the phosphorus in the primary influent. Rather than supplement phosphoric acid or alternative sources of phosphorus, we ran an analyses on the belt press and digestor supernatant. There were high levels of phosphorus in the streams. We asked them to rearrange their timing for decanting and dewatering in order to utilize the nutrients available in those streams to supplement when the drinking water plant is discharging.

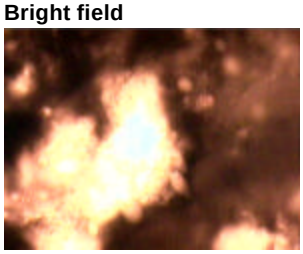
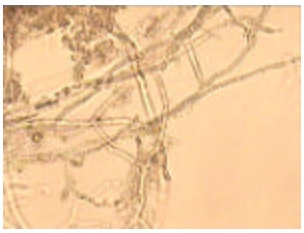
We have seen nutrient deficiency turn an entire wastewater plant to slime. The clarifiers would not settle, the aeration basins had floating foam and scum on the surface. We have seen it at a dairy, a juice factory, a meat plant, a winery, and a chocolate factory. We were running a MLSS of around 4000-ppm at a frosting factory. Overnight, someone dumped a load of those simple sugars found in frosting. We came back in the morning to a MLSS of 16,000! Luckily, we had a DAF prior to the aeration basin, so there was more than enough DO, but we were a bit nutrient deficient. We saw this at a winery, the typical BOD was 8000ppm. Overnight again, a loading up to 32,000 BOD came through. Granted, these are extremes, but it shows you how quickly changes can happen in a plant.

Here is a case history with a plant that had nutrient deficiency.

Here is our first sample. This was from a **Pig farm.** There were some round, compact floc structures, some stalked ciliates present and some rotifers. They are having a hard time dewatering the sludge and it was very jelly like.
We looked closer, guess what we saw-

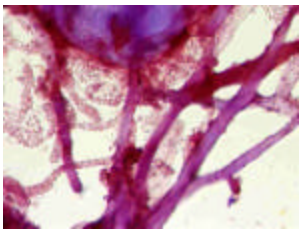



Here is a photo of compact floc and stalks 100x Bright field Here is fingered zooglea at 400x Bright field

The polysaccharide coating was very high here 100x India Ink There was a ton of Fungi 400x Bright field.

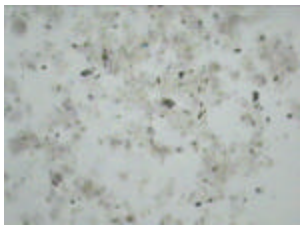
We did perform Gram and Neisser stains.

1000x Gram stains Fingered zooglea 1000x Gram stains Fingered zooglea and Fungi

There was a ton of fingered zooglea and fungi present. We asked them if the pH was low at the plant. They adjusted pH at the plant and checked for nutrients since they were deficient at the plant slightly. The plant now has solved its problems with the help of the microscope!

Here is a second one at a packaged meats plant-




This plant had weak, dispersed floc, but some black spots in the floc structures. The pH of the influent was 5 and the pond was at 6.2. There was evidence of low DO by the black spots. There were very few filaments, but some fungi and mostly zooglea. We asked them to adjust the pH, increase their nutrients and bump up the DO if possible.

Contact Environmental Leverage if you need help with troubleshooting your plant.

We work with many companies and we have numerous distributors. We are just starting to add polymers to our product line. One of the gentlemen that work with us has provided a serious of articles on polymers. We will add our own training to supplement this after these articles, since there are numerous areas you can cover with polymers, solids handling and dewatering issues.

Randy Homan
Promereo Group, LLC, Managing Partner

In this issue we will begin the first of a multi-part series on polymer. This issue will explain just what polymer is as well as lay out guidelines for procuring polymer in the most cost-effective manner possible. Future issues will detail polymer selection, optimization and tracking.

For many users of organic flocculants, the dirtiest job in wastewater is buying polymer. The nature of the chemical water treatment market leads to confusion. The water treatment market is splintered into tens of thousands of companies worldwide, of greatly varying abilities, supplying over $17 billion in polymer and related chemicals. While municipal wastewater plants are the largest purchasers (17 percent of the total), there are many other users: power generators, municipal water treatment plants, refineries, pulp and paper mills, oil and gas producers, food processors, metal working companies, chemical producers, electronics manufacturers, and mines. Given this wide variation in markets it is essential that you work with a vendor(s) who understand your specific needs and can articulate a solution.

Polymer prices have risen rapidly over the last two years. To maximize your dollars and guarantee a good deal at a fair price not a fair deal at a good price you first need to understand just what polymer is. Ionic charge and molecular weight are important and what most definitions focus on but because our focus is on you, the end user, we are going to give you a more functional definition than you may have heard in the past.

Polymers are a process critical, mature chemical, manufactured to a high standard for use in various solid-liquid separation applications across a wide range of industries.

Process critical: You purchase polymer because you must. Facilities that are designed to use polymers as part of the solids handling process cannot function without them.

Mature chemical: All significant research into polymer characteristics for water treatment has been completed. The last major hurdle, cross-linking, was completed almost 15 years ago. Since than most “new innovations” represent tweaks of existing products. The vendor and buyer now share the responsibility to achieve maximum performance with the existing products.

Manufacture of polymer is highly technical: The product that comes from the reactors to the loading docks is almost always on specification.

Wide range of industries: Ore floatation, oil drillers, paper mills, dredging operations and super adsorbent diapers are just a few of the many users of this technology in addition to treatment plants.

Once you accept the concept that you are buying a mature chemical that has the potential to have a great impact, for either good or bad on your day to day operations, than the rest of the process becomes easier. Your focus, given the impact of polymer needs to be on more than just polymer; ask questions,

involve others at the plant and work with vendors who take your situation seriously.

Some general tips for dealing with vendors.

1. Be honest and straightforward. Information should be *consistent*. Actual or estimated quantities should be as accurate as possible. This eliminates submission of irrelevant proposals since not all companies are competitive in all situations.
2. There can be only one winner. Make sure that your method for determining the lowest bid or quote will identify the most cost-effective solution. Does the proposed package include more than polymer? Any product that does not include training, audits and related services to maximize performance does not represent a true value.
3. Use precise terms and unambiguous wording. If the contractor must provide equipment, than tell them is no uncertain terms. Vague phrases like “as necessary” should be avoided. You should state any minimum or maximum performance standards and operational, compatibility, or conversion requirements. Clearly state who pays freight.
4. Do not use overly technical language. The more restrictive the specifications, the less competition they will generate. Provide sufficiently detailed specifications to ensure that you will get what you want at a fair price, while omitting unnecessary details that unduly limit competition.
5. Government or industry Standards: If the item you are purchasing must comply with an established standard, NSF for example, it should be stated.
6. Pay attention to the timing of your contract and give vendors sufficient time to prepare proposals.
7. Pricing formats should always be in pounds as delivered. Pounds as delivered are easy to verify. Never buy polymer by the gallon, bucket, bag or percent activity.
8. Quality requirements: Always take and retain a sample of product(s) tested.
9. Delivery terms: You should include where and when items should be delivered, and who bears the risk of loss while the items are en route.

Once you have articulated your needs the next step is to determine which of four basic formats you want to use for evaluating performance. Over time, four standard ways to judge polymer’s performance have evolved: price alone, performance alone, price and performance, and fantasy. Performance based bids, particularly when focused on reliable knowledgeable suppliers, are the most effective in determining true cost of the chemical while fantasy bids are the most prevalent in the market place.

Price alone – in the price alone bid there may or may not be some minimum number that must be met for cake or capture. Requirements are low enough that every vendor should easily qualify. Award is based on price per pound for polymer. This method is applicable to plants that have no disposal costs past dewatering or in which any results above a minimum are meaningless. For example, there may be very minimum requirements for cake dryness when the city’s landfill does not charge the local plant for accepting dewatered sludge. This method is sometimes referred to as by industry insiders as “if it is white, it is right.”

Price performance – Similar to price but there are at least two performance numbers, usually cake and capture that must be met. These requirements tend to be more difficult to meet and are based on operational need. Dosage is tracked and recorded. Price times dose forms the basis of award. Although this method will generally pick a good product, it often times does not pick the best product.

Performance - Is a method where variables are assigned a cost and lowest overall cost forms the basis of award. Performance based bids allow the buyer to differentiate products on the basis of improved capture, higher cake, lower dose, all factors that contribute to greater ease of use. Simple but effective form of this bid for a dewatering application would be: Award = (%cake ÷ disposal cost) + (pounds of solids in filtrate × treatment costs) + (polymer dose × polymer price)
All reliable suppliers of polymer can assist you in setting up a program that meets or specific needs.

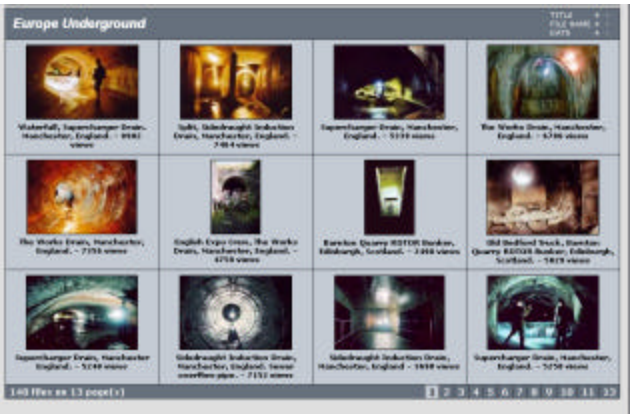
Fantasy – Failure is built into the process. Facility bases purchase on historical criteria that is no longer applicable or have set goals that are unattainable. Yet invariably there will be an award. The plant never achieves, in day to day operations, the results or dosages that were reported during the selection process. Verification is poorly supervised leaving the end user in many cases with a product that makes plant life more difficult than it has to be.

Summary: The plant should establish the goals that they need to accomplish, be consistent in reaching those goal and work with vendors who share their vision. And remember, a well thought out plan will not be complicated. During the heights of the Cold War, in the race to space between the United States and the USSR, the US spent millions of dollars developing a pen that could write in any condition. The Russians used a pencil.

Next issue covers compliance and testing.

Misc. websites

http://siologen.net/pbase/thumbnails.php?album=9



Check out some of the cool underground sewers In Europe

http://photos.innersource.com/group/8557
Wastewater treatment plants photos in Illinois

http://www.waterandwastewater.com/plant_directory/North_America/United_States/index.html

Water and Wastewater Plant Directory in the US

http://www.micrographia.com/aadirpgs/specall/specgen/spegen01.htm
Specimen Gallery
Tons of photos and identification of higher life forms typically found under the microscope in MLSS samples.

Environmental Leverage Inc. offers consulting services, beneficial reuse, training and bioaugmentation programs that can help reduce your surcharges.

Contact our office today to find out how your can start saving money and become more efficient at your plant!!!
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.

Training Classes
Sign up now- a few spots open

One Day Wastewater Training and Troubleshooting
Activated Sludge Process Control
January 18th, 2006
Village of New Lenox Wastewater Treatment Plant
301 N Cedar
New Lenox, IL 60451

Registration Fee- Full Course- $150

Two Day Filamentous ID Hands on workshop
"Filamentous Identification the Easy Way" Seminar
Wastewater Systems
March 21 &22, 2006
Register Early, Class Size Limited
Village of Algonquin
125 Wilbrandt Street
Algonquin, IL 60102
Registration Fee- Full Course- $295

COMING IN THE NEXT MONTHS . . . . .

Polymer Optimization
Dewatering issues