



Activated Sludge Microbiology Evaluation
Plant Eastern USA
September 14, 2009

Introduction:

Three samples were received at the EBS lab on September 15, 2009 from Plant in Eastern USA. These samples were for initial testing and a treatability study to monitor changes in biomass and effluent with various concentrations of a new defoamer. After speaking with the engineer the treatability study portion of the testing was cancelled. They tried to run the defoamer in the waste treatment system and it had adverse effects. The initial testing was completed. The results are included below in the analytical data table and the microscopic evaluation table.

Analytical Data:

	Influent (after pH adjustment pit)	RAS	Aeration Basin Mixed Liquor
pH	6.87	7.11	7.24
NH3 as N (mg/L)	7.28	7.11	1.56
oPO4 as P (mg/L)	4.46	3.88	4.02
MLSS/TSS (mg/L)	55	15160	2950
MLVSS/VSS (mg/L)	53	13540	2640
30 Minute Settling (mls)			833
SVI (mls/g)			315.5
Supernatant TSS (mg/L)			26
DOUR (mg/l/hr)			4.1
SOUR (mg/L/hr/g)			1.6
sCOD (mg/L)	1222	160	122
tCOD (mg/L)	1412		
tBOD (mg/L)	687		
sBOD (mg/L)	574	76	51

Microscopic Evaluation

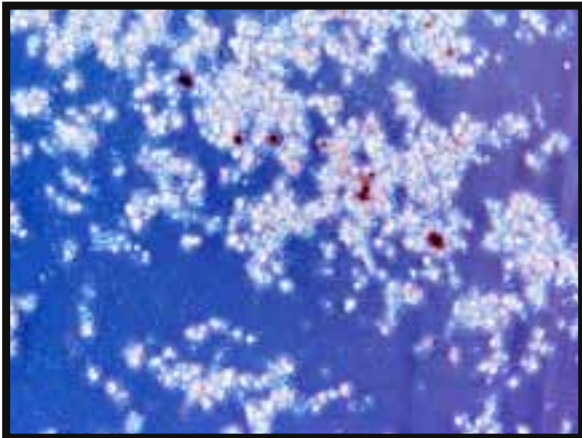
	Influent	RAS	Aeration Basin Mixed Liquor
Floc Structure			Small to medium-sized, irregular, and diffuse.
Dispersed Bacteria (0 - 3)			1
Pin Floc (0 - 3)			1
Filament Rating (1 - 6)			3
India Ink Stain for Polysaccharides (1 - 3)			2.5
Zoogloea Abundance (0 - 3)			2.5
Higher Life Form Distribution			
Flagellates			7
Free swimming Ciliates			1
Stalked Ciliates			0
Rotifers			0
Maturity Index			1.13

Comments & Recommendations:

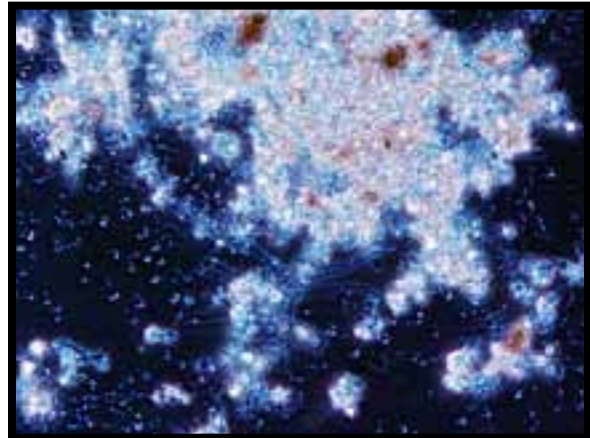
Settling is impaired by polysaccharides and Zoogloea. Zoogloea are a specific type of bacteria that produce a collection of extracellular polymer strands composed of polysaccharides. This makes them “sticky” so that they form floc. They can be good for settling in normal amounts, but can hinder settling if they become excessive. These samples had elevated amounts of Zoogloea, which inhibited the settling of the sample. The supernatant, which is used as an indication of effluent quality, was very clear and had low solids and COD concentrations. Therefore, if you can get the sludge to settle, the effluent will have good quality. The presence of Zoogloea and polysaccharides was confirmed using the India Ink staining procedure (see photos). The India Ink stain is an excellent tool for estimating the amount of extracellular polysaccharides in the biomass. This is useful in diagnosing various problems, including nutrient deficiency and the presence of organic acids. The India Ink stain for this sample had poor floc penetration of the ink. The white areas seen in the photos below are areas where the Zoogloea colonies are present in higher numbers. Ideas for controlling Zoogloea include: maintaining DO at 1ppm or higher, lowering F:M ratio by increasing the MLSS, and encouraging non-Zoogloea growth via the EBS BAC unit recommended previously.

The examination includes an assessment of higher life form distribution in the MLSS sample. While this assessment is of minimal value on a one-time basis due to the site specific nature of higher life form distribution, it can be a valuable tool if tracked over time. At EBS, we utilize a concept we call the Maturity Index, which is a weighted average based on the relative maturity of the life forms, with flagellates and amoeba (the lowest life forms) counting one point, and rotifers (the most advanced life form) counting four points. The ideal Maturity Index will vary from system to system, but for an activated sludge system, one would expect it to be in the 2.0 – 2.5 range under optimum conditions. The maturity index of the mixed liquor sample was very low. This indicates a very young sludge that may have been affected by recent loading upsets or something inhibitory or toxic to the bacteria.

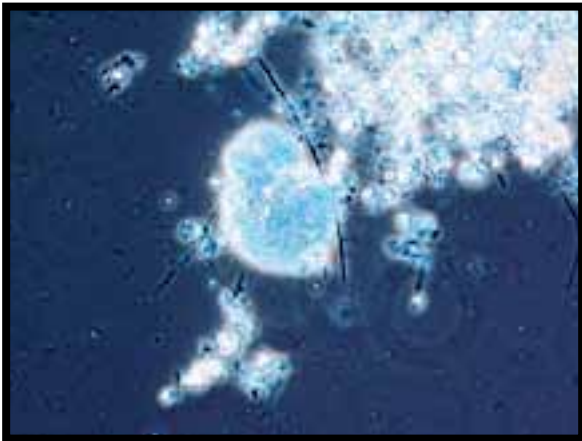
Aeration Basin Photos:



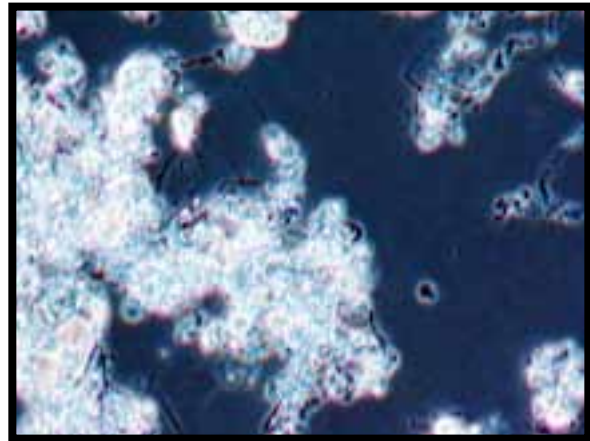
100X phase contrast, wet mount. Floc size is small to medium, irregular and diffuse.



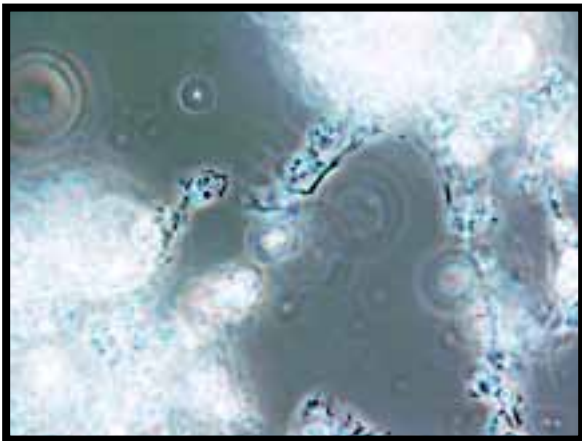
100X phase contrast, wet mount.



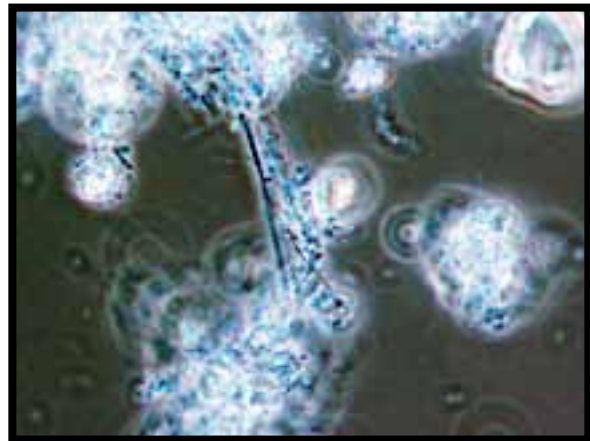
400X phase contrast, wet mount. Zooglia are present in elevated amounts.



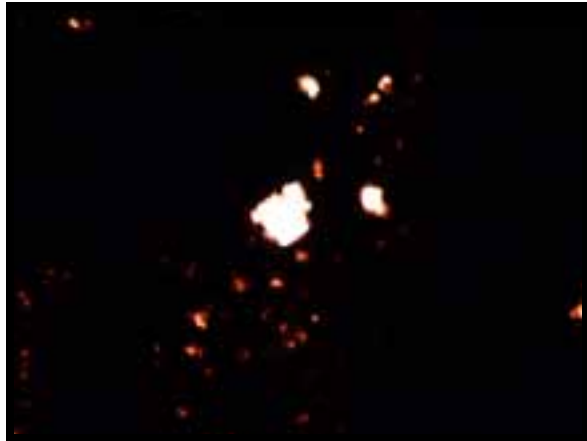
400X phase contrast, wet mount.



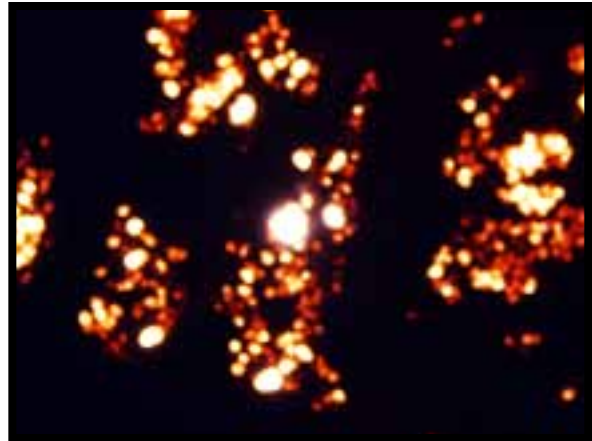
1000X phase contrast, wet mount. Filamentous bacteria are present in common amounts and are bridging the floc pieces.



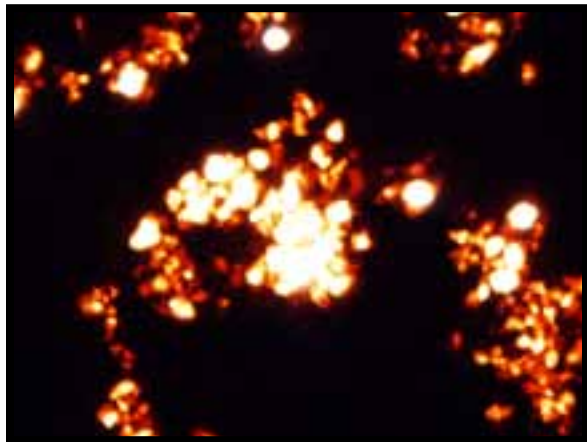
1000X Phase contrast, wet mount.



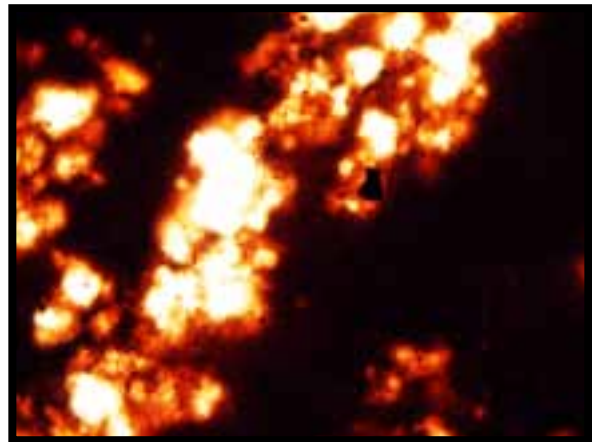
100X, India Ink stain. White areas indicate areas of elevated polysaccharides that do not allow the ink to penetrate the floc very well.



200X, India Ink stain.



400X India Ink stain.



1000X, India Ink stain.