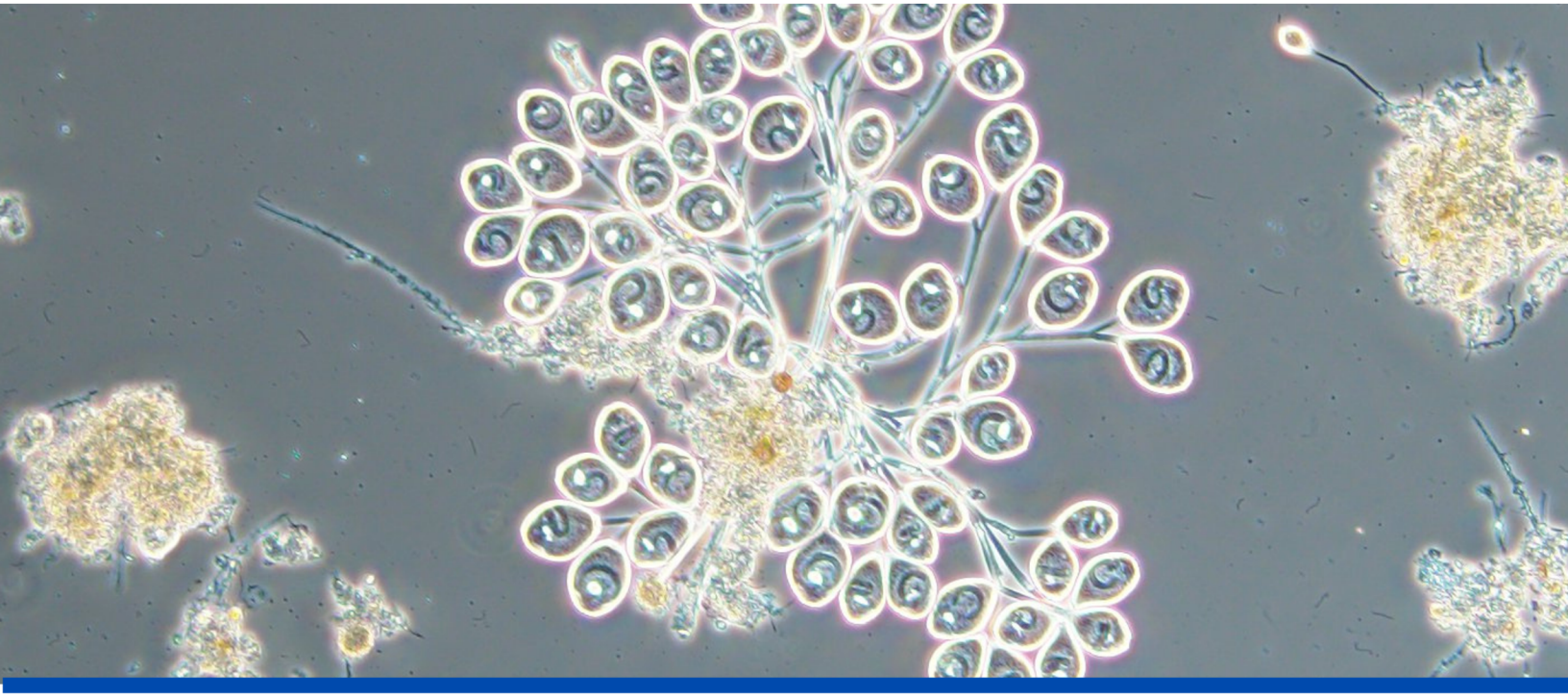
July 2025

EBS
An Employee-Owned Company
Comprehensive Wastewater Solutions

ISSUE 6

LAB LINES

Wastewater Consultants Like No Other



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Don't miss your last chance in 2025 to join us!

EPS AND FLOC FORMATION

When it comes to healthy, well-settling sludge, it's not just about the bugs; it's about how they stick together. That's where EPS (Extracellular Polymeric Substances) come in.

SO WHAT ARE EPS?

EPS makes up the sticky matrix that bacteria naturally produce. Think of it like microbial glue: a mix of proteins, polysaccharides, DNA, RNA and other compounds that hold bacterial cells together in flocs.

There is a sweet spot in the ratio of EPS to biomass where flocculation is strong, solids separate well, and biological treatment remains stable.

Too little EPS? (<8% of the MLVSS)
Your biomass becomes diffuse and more difficult to settle.

Too much? (>15-20% of the MLVSS)
Your biomass can bulk in secondary clarifiers, poor dewatering, and/or foaming issues.

Here are some examples of what you might see in your settling test!

LOW EPS (<8%)	HIGH EPS (>15-20%)	BALANCED EPS 8-12%)
		
Turbid supernatant, (TSS >50 mg/L). Pin floc that won't settle.	Slimy bulking sludge with SVI >150 mL/g. Foam occurrences are common	Defined settled sludge layer with a SVI <150 mL/g, clear supernatant

Your Why Floc Formation Matters

The basic premise of successful activated sludge treatment is the formation of flocculated biological solids that can be settled or floated to create a thickened sludge for wasting/recycle and clean water for discharge.

Strong, compact flocs:

- ✓ *Settle better*
- ✓ *Trap more solids*
- ✓ *Deliver more consistent effluent*
- ✓ *Are easier to handle and dewater*

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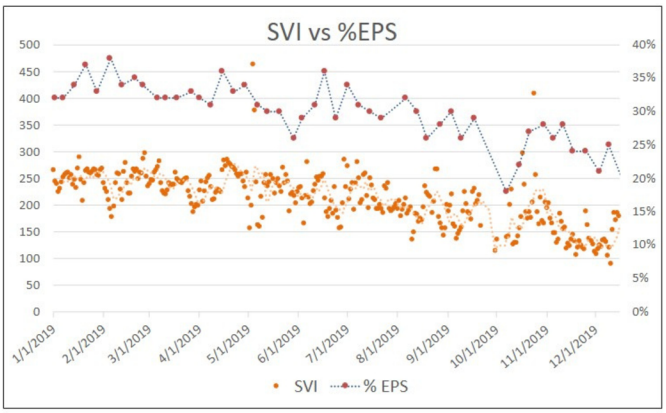
WHAT AFFECTS EPS AND FLOC FORMATION?

A few key drivers that impact EPS and Floc formation:

- *Carbon and nutrient source availability:* Under low nutrient (N/P) and high carbon conditions, bacteria can't form new cells, so they shunt excess carbon into storage polymers or EPS (polysaccharides) instead.
- *Toxic shocks or pH swings*: Changes in loading and pH swings can stress the biomass, resulting in the exacerbation of EPS production responses, or it can break down existing flocs.
- *Sludge age:* Very young or very old sludge often struggles to maintain stable floc structure.
- *Shear forces:* Too much mixing can tear flocs apart.

Check out this study:

An EBS client faced challenges with nutrient and BOD loading fluctuations following an extended outage. Over the course of a year, we monitored their EPS and settling rates. We discovered that as their EPS% decreased, so did the SVI, which impacted the settling rates in their clarifiers.



FINAL THOUGHTS

Understanding and managing EPS production is essential for maintaining healthy floc formation and consistent system performance. Striking the right balance allows for reliable settling, efficient solids separation, and stable biological treatment. At EBS, we help facilities take a closer look at what's happening in their biomass whether it's too much EPS, too little, or something else impacting how flocs are forming.

With the right tools and insight, we can help your biomass stay in that “just right” zone where treatment runs smoothly, effluent stays clean, and hopefully your operational headaches are minimized.

Have questions about your sludge health or floc structure? We’re here to help.

References:
Jenkins, D., Richard, M. G., & Daigger, G. T. (2004). Manual on the causes and control of activated sludge bulking, foaming, and other solids separation problems (3rd ed.). Boca Raton, FL: CRC Press.
Wang, Z., Wang, Z., & Tang, W. (2022). A review of the production, composition, and roles of extracellular polymeric substances (EPS) in biological wastewater treatment. Journal of Environmental Management, 317, 115325.Design: Micrographs of EPS production under low/mid/high conditions

ASK THE BIOWIZARD

IS MY BIOMASS ALIVE?

WHY HIGHER LIFE FORMS ALONE DON'T ALWAYS TELL THE WHOLE STORY FOR AEROBIC SYSTEMS

One of the most common questions we hear during our training sessions is, *"Is my system or biomass even alive?"* It's a valid question, especially if your microscopic exam isn't showing much activity from higher life forms (HLF) like complex ciliates and rotifers. It's easy to assume something is wrong when your slide isn't teeming with motion. Don't jump to conclusions just yet.

The absence of HLFs doesn't necessarily mean your biomass is unhealthy or inactive. While these organisms are helpful indicators, they're only one piece of a much larger biological puzzle. In fact, some of the healthiest low solid systems may show little to no HLFs.

If a system that typically has a robust HLF population experiences an upset, biological activity can return much faster than it takes for the HLF population to reestablish itself.

Healthy papermill biomass!

SIGNS OF A HEALTHY BIOMASS UNDER THE MICROSCOPE:

- **Dense, larger and irregular floc structures**
- **Low to moderate levels of active dispersed bacteria in the bulk water**
- **Moderate polysaccharide production**
- **Filament growth that supports floc formation without hindering compaction**

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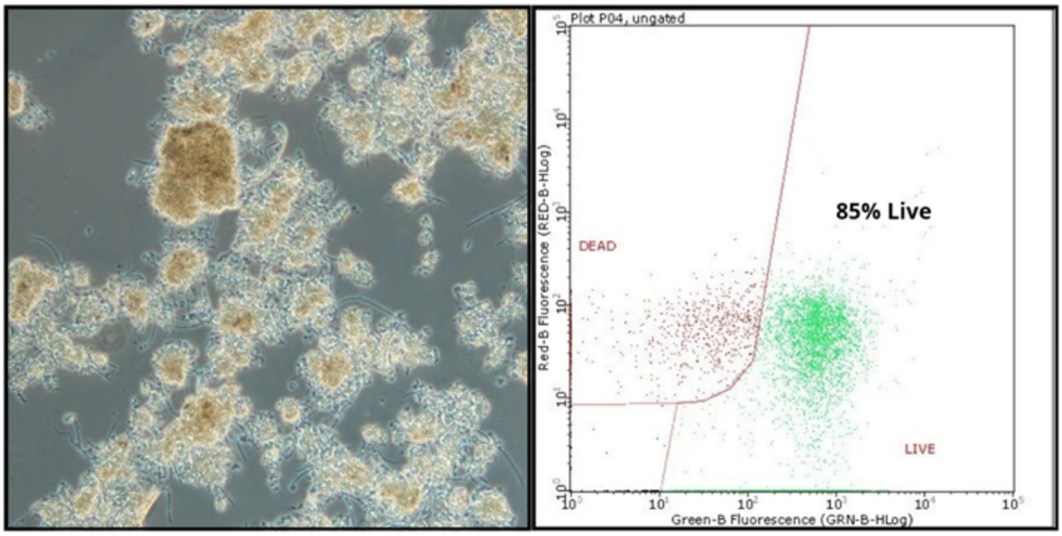
>>> BEYOND THE MICROSCOPE

The most reliable assessment of biological health in an aerobic system often comes from a combination of tests that support what you see.

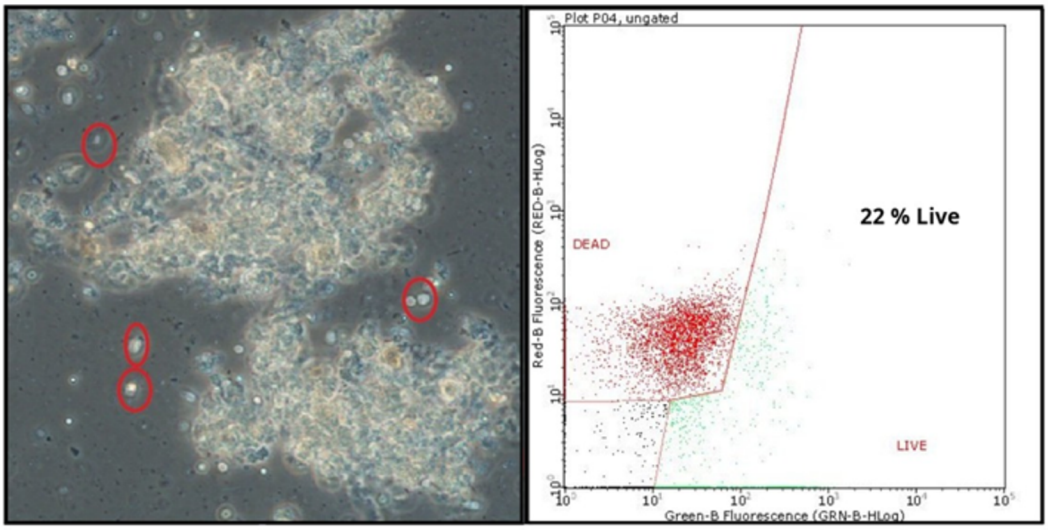
- **DOUR (Dissolved Oxygen Uptake Rate)** – Indicates metabolic activity of the biomass.
- **Fed DOUR** – Measures how the biomass responds to food addition.
- **Flow Cytometry** – Provides live vs. dead cell count using fluorescence staining.
- **Viable/Culturable Cell Counts** – Confirm active colonies capable of reproduction which is critical for long-term system stability.

Take these examples for instance:



Sample 1 had a no visible HLF and a live cell percentage of 85%

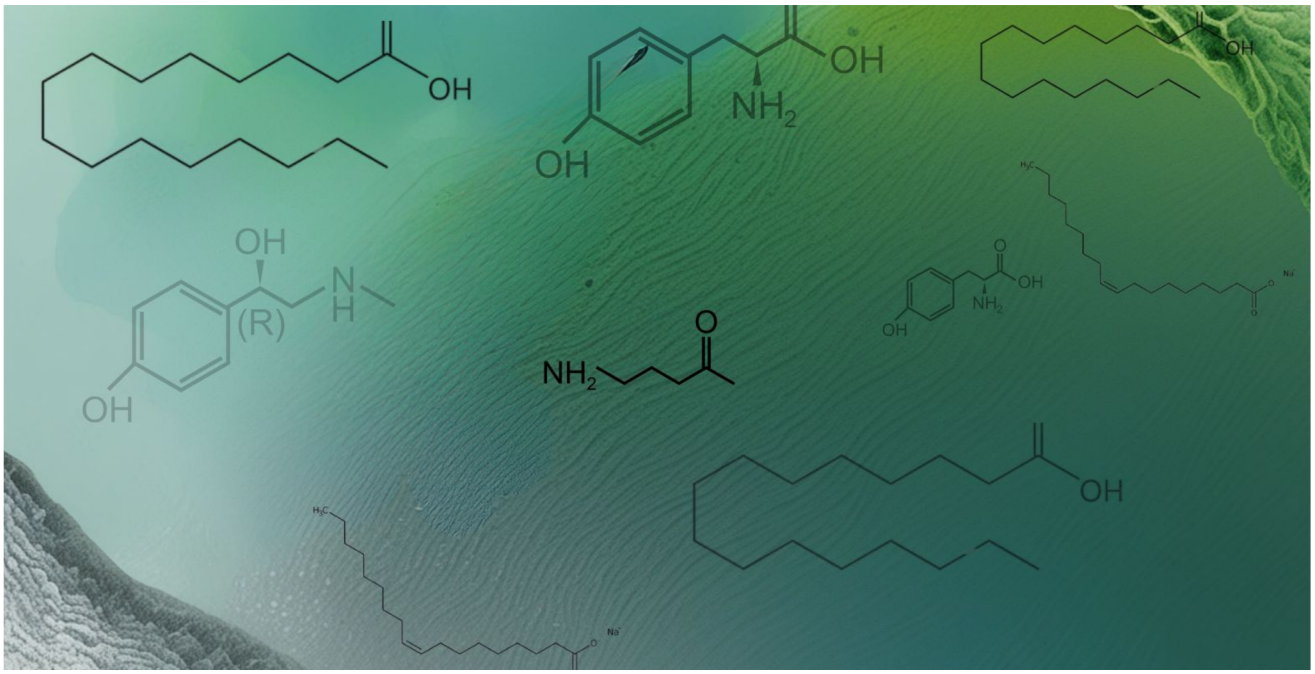
Sample 2 had several flagellates and a live percentage of 22%. (Indicative of a system that is in recovery after an upset).



>>> FINAL THOUGHTS

Is your biomass alive? Look for the clues: if your system is removing BOD, flocs look healthy, and your bacteria are actively respiring- even if HLF are missing, the answer is probably ***YES!!***

PERFORMANCE DECLINING AND DONT KNOW WHY ?



Is your system's performance declining but you can't figure out why?
Operators often respond by adjusting process settings, tweaking chemicals, increasing aeration yet nothing seems to work. They start to wonder if the operating process is even the real problem or if it's something more? It could be a specific group of toxic or inhibitory compounds that have slipped through undetected. Over time, chemicals such as biocides, surfactants, pesticides, and fatty acids can accumulate in the biomass and interfere with biological treatment.

That's why we run targeted analyses!

- Quaternary ammonium compounds (QUATs/QACs)
- Long chain fatty acids (LCFAs)
- VOCs (BTEX and Reduced Sulfur Compounds)
- Resin acids
- Heavy metals (Zn, Cu, Ni, Al, Fe, etc.)
- Terpenes
- Surfactants (anionic/nonionic)
- Volatile fatty acids
- Organic acids volatile, long-chain, and resin acids

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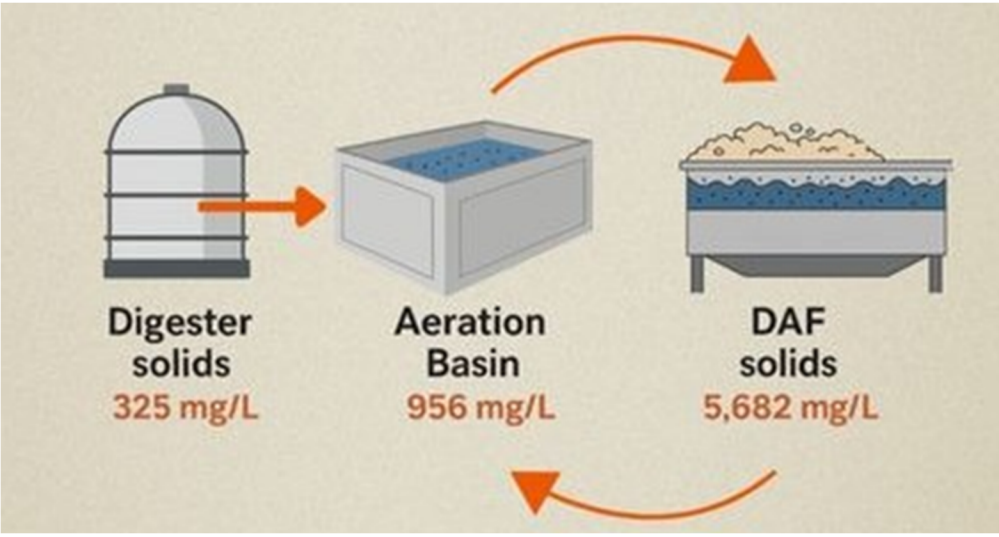
WHAT HAPPENS OVER TIME?

When accumulated into the biomass, these compounds can reach concentrations that can suppress microbial growth and activity, interfere with floc formation, or destabilize the wastewater treatment process. Actual thresholds will vary among the compounds and from system to system.

For one of our clients, the accumulation of long-chain fatty acids (LCFAs) led to a major upset. They were suddenly unable to effectively dewater biological solids from their secondary DAF. In response, they submitted samples for advanced chemical analysis to help find out why.

The results pointed to poor anaerobic digester performance that had contributed to the bioaccumulation of LCFAs in the biomass. Compounded by high return rates and poor dewaterability, the LCFA concentrations quickly escalated throughout the system.

Digester solids contained LCFA concentrations of 325 mg/L upon entering the system. The Aeration Basin biomass reached 956 mg/L, while the DAF solids spiked to an excessive 5,682 mg/L. The recirculation of solids between the DAF and Aeration Basin (AB) caused LCFAs to cycle continuously, compounding the problem over time.



By identifying the point-source of LCFAs, loading to the AB was reduced and secondary DAF solids were hauled away. This critical decision helped our client lower LCFA concentrations, improve biological treatment, and enhance secondary DAF performance. As an added bonus, it also reduced chemical usage which reduced overall operating cost! If you're trying to troubleshoot your system and the usual tests aren't telling you anything, it might be time to level up your testing. Give us a call today!

Fall 2025 Wastewater Seminar

$100 OFF REGISTRATION UNTIL 9/01/2025

October 7-8th

Mandeville, LA

Newly Designed Agenda!

Includes:

★ **Breakout Sessions** ★ **Troubleshooting and Data Review**

Choose from:

ACTIVATED SLUDGE CLASS

- Intro to activated biological treatment
- Process control testing and data interpretation
- Solids management
- Microbiology
- Secondary clarification fixes
- & more!

AERATED STABILIZATION BASIN CLASS

- ASB basics
- Additives in ASBs
- Basic & advanced microbiology
- Advanced chemical analysis
- Odor control
- Applied treatability
- & more!

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