



AQUAFIX

Wastewater Laboratories

University of Wisconsin Research Park



Date: 01/04/2023
To: [REDACTED]
Sample(s): Mixed Liquor & Foam
Date Received: 01/04/2023
Date(s) Analyzed: 01/04/2023
Sample Analyzed By: Natalie Walton; Aquafix
Objective: Determine the cause of foaming in the [REDACTED] and recommend treatment.

Overview of Findings:

- The cause of foaming in the [REDACTED] is due to filamentous bacteria, specifically Nocardia-like Organisms (NALO). When abundant enough, NALO form a tangled mat like structure that floats due to their low density fatty cell walls. This floating structure results in the formation of a strong, stable foam. NALO thrive in systems with high levels of incoming fats, oils, and greases (FOG) and a high sludge age.

****Details on microscopy and treatment recommendations are available at the end of the report.****

Microscopic Observations: Mixed Liquor

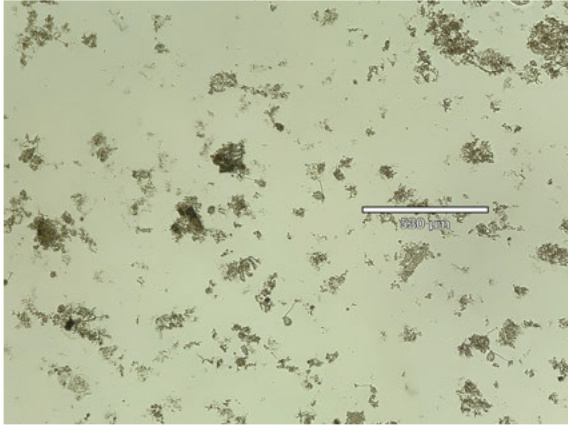


Figure 1-40x (m): Overview of floc and filaments in the Mixed Liquor sample.



Figure 2-100x (m): Moderate levels of stalked ciliate colonies were observed.

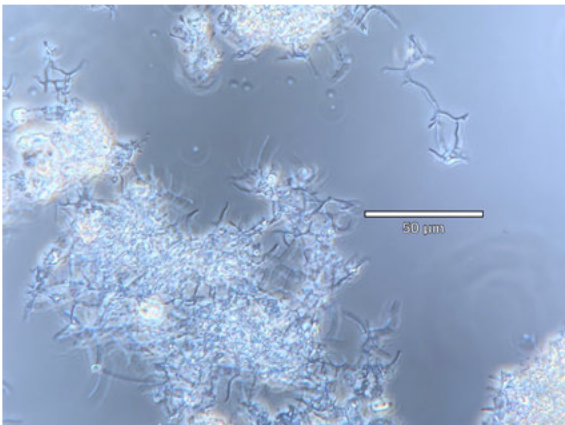


Figure 3-400x (m) Phase Contrast: Floc were dominantly white in color when viewed under phase contrast. The occasional tan region was observed in more dense areas.

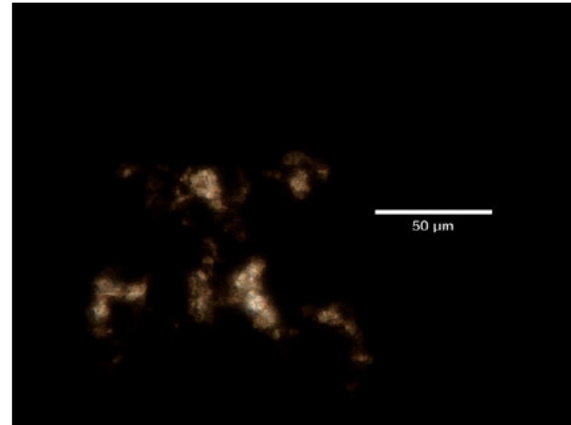


Figure 4-400x (m) India Ink Stain: Low levels of EPS were observed within floc.

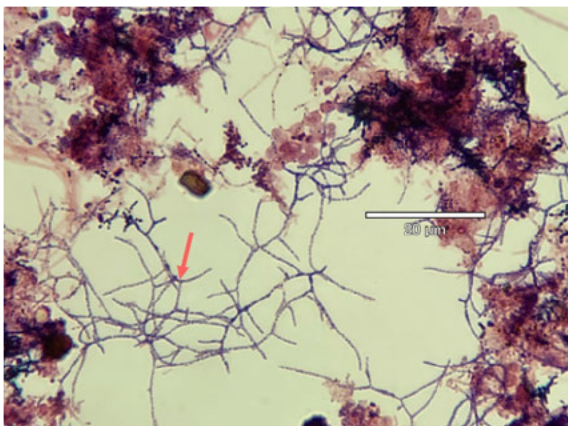


Figure 5-1000x (m) Gram Stain: High levels of NALO were observed in the ML sample.

Microscopic Observations: Foam

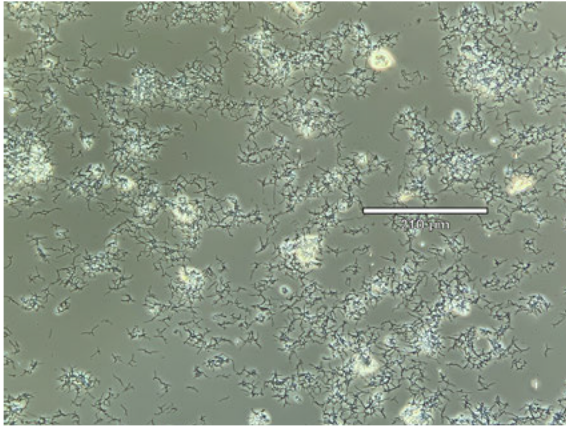


Figure 6-100x (m) Phase Contrast: Overview of the Foam sample.

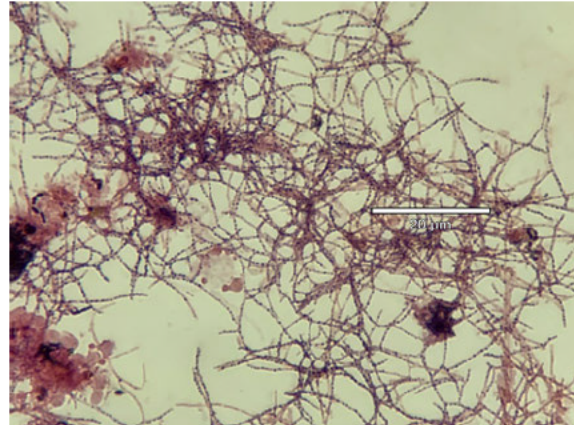
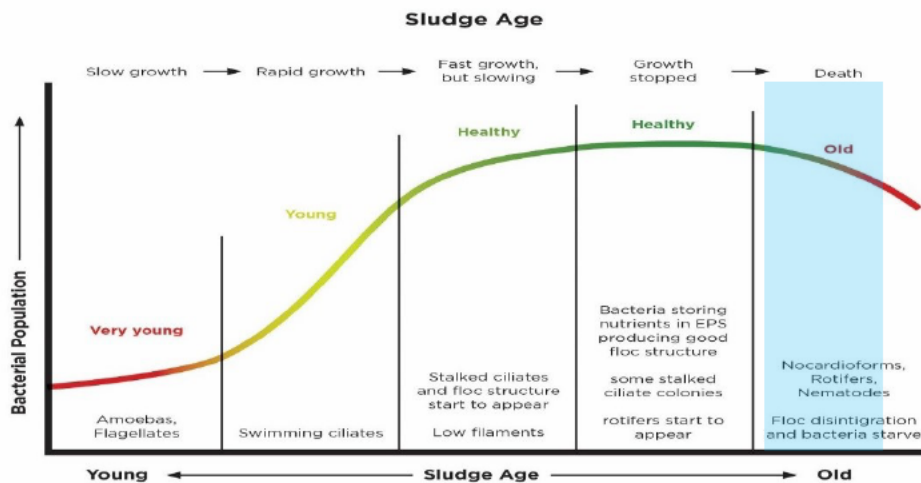


Figure 7-1000x (m) Gram Stain: Very high levels of NALO were present.

Observations Discussion & Results:

Floc in the Mixed Liquor sample were dominantly small in size and irregular in shape (Figure 1). Since floc are small and not very dense, oxygen is able to adequately penetrate into floc (Figure 3). These small floc are likely the result of a high sludge age. When the sludge age is high, floc begin consuming extracellular polymeric substances (EPS) in place of the limited available nutrients. Since EPS acts as a glue like substance that helps floc forming bacteria stick together and form strong floc, these decreasing levels cause floc to break apart and disintegrate. This in turn leads to floc that do not have enough mass to settle properly. A high sludge age can be determined by the low levels of EPS (Figure 4), stalked ciliate colonies (Figure 2), high levels of filamentous bacteria, and nematodes observed in the ML sample.



(The blue shaded area on the diagram above represents the approximate sludge age in the [redacted])

Mixed Liquor

Rank	Filament	Abundance	Cause
1	Nocardia-Like Organisms	High	High FOG; High Sludge Age
2	Type 1851	Low	Low F:M

Foam

Rank	Filament	Abundance	Cause
1	Nocardia-Like Organisms	Very High	High FOG; High Sludge Age

<https://teamaquafix.com/nocardioforms/>

<https://teamaquafix.com/type-1851/>

Recommendation(s):

- The most effective way to treat the foaming in the [REDACTED] is to give the floc forming bacteria an advantage over the foam causing filaments, NALO. This can be done by controlling the factors triggering NALO growth. Since NALO favors a high sludge age, increasing wasting in the [REDACTED] plant is recommended as it will not only lower the sludge age but will also help stimulate the growth of new, healthy floc forming bacteria.
- NALO also favor systems with high incoming FOG and can utilize this FOG quicker than floc formers. However, if this FOG is broken into short chain fatty acids, floc formers can more easily uptake it, thus allowing them to outcompete NALO. This process can be accomplished with a product such as Qwik-Zyme L. We recommend continuing the use of Qwik-Zyme L but at an increased dose rate in the [REDACTED]
- NALO can also get the upper hand by utilizing the byproducts from grease degradation to continue growing. By adding a blend of micronutrients to help floc formers more optimally uptake these byproducts, NALO will be put at a further disadvantage. This can be achieved with the addition of Foam Buster. Therefore, we recommend continuing the use of Foam Buster.