



Probiotic[®] SOLUTIONS

Wastewater Microscopy

By

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Why Wastewater Microscopy

- Microscopy is in addition to chemical/physical
 - Assists in the determination of the health of the treatment system
 - As well as evaluating treatment problems that may be occurring
- Simply stated healthy “Bugs” equal more stable sludge and processes

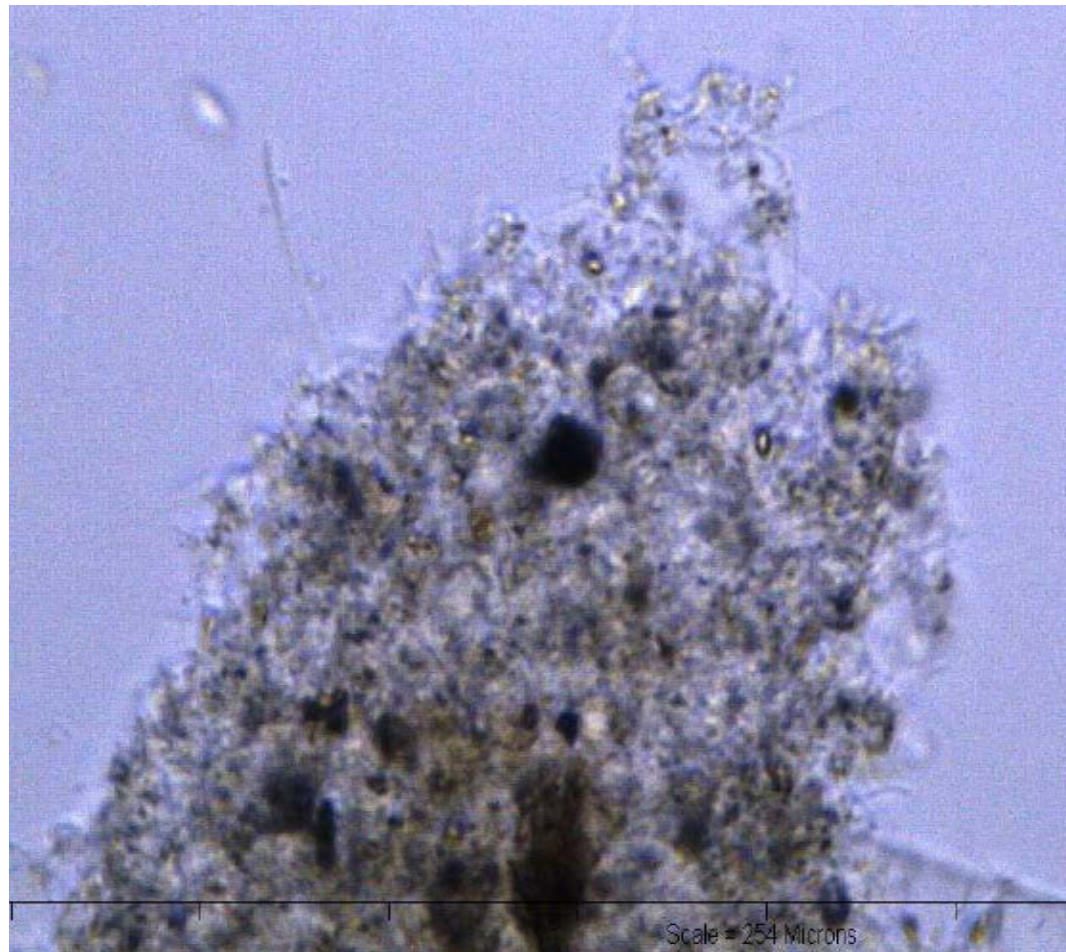
Factors That Impact Microbial Growth

- ***Temperature***
- ***pH***
- ***Osmotic Pressure***
- ***Chemical Requirements***
 - Carbon
 - Nitrogen, Sulfur and Phosphorous
 - Trace elements/nutrients
 - Oxygen
- ***Toxicity***

Got Floc?

- Where do you find microbes in wastewater treatment?
- **Floc**
 - is mostly carbonaceous, also contains proteins
 - Floc is held together with a polysaccharide “slime” layer
 - To form irregularly shaped flocs with a strong “backbone”, a small abundance of filamentous bacteria are needed.

Typical Floc



Floc Morphology

- **Color**- indicates the age of the biomass.
 - Clear indicates a very young biomass.
 - Golden brown indicated a healthy floc.
 - Black indicates the floc is turning anaerobic and running out of air or is older.
- **Shape and Structures**- Weak, Lacy, Open, Diffuse, Compact, Firm, Rounded
- **Size**- regular or irregular, pin or large
- **Density**- more firm and compact a floc is, the better it will settle

Looking for Higher Life Forms

- Analysis usually performed under the microscope at 100x
- **Higher Life Forms (HLF)** can be indicators of:
 - Toxicity
 - Available “food”
- **Examples of HLF**
 - Amoebas
 - Flagellates
 - Crawling and Stalked Ciliates
 - Rotifers
 - Water Bears
 - Bristleworms
 - Nematodes

- ***Habitats of different HLF***
 - Amoeba and flagellates grow on high prey densities of dispersed bacteria found when there is soluble cBOD present.
 - Crawling Ciliates, Stalked Ciliates, and Rotifers are more efficient and grow on lower dispersed bacteria prey densities associated with good cBOD removal.
 - Bristleworms and nematodes grow in longer MCRT systems.

- **Examples**

- Free Swimming Ciliates

- Young to middle aged sludge
- May be present in stable sludge
- May indicate low D.O. levels
- Feed on bacteria

- Stalked Ciliates

- Middle aged sludge
- Indicate stable sludge/floc
- Feed on bacteria



– Rotifers

- Present in older sludge
- Increasing stabilization of organic wastes, lower TSS and BOD
- Sensitive to toxicity



- ***Invertebrate Life Forms***
 - Includes water bears, nematoids, etc.
 - Require long sludge age
 - Indicator of good nitrification as ammonia is toxic to them



- ***Minimum amounts***
 - support floc,
 - Increase settleability in clarifiers
 - Good BOD and pin floc removers
- ***High concentrations***
 - High concentrations cause sludge bulking
 - Impact SVI and reduce settleability
 - Also causes foaming

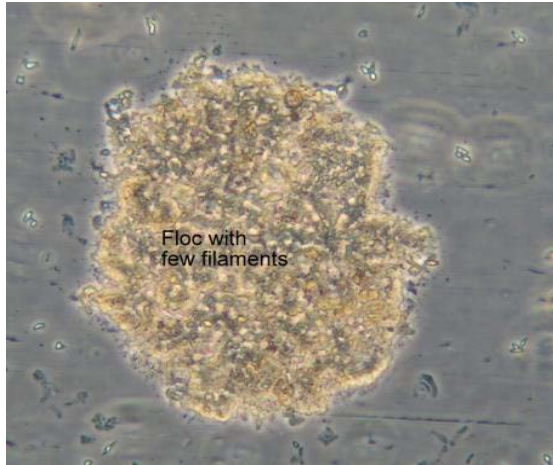
Filamentous Bacteria Cont.

- ***Root causes for excessive filamentous bacteria***
 - Nutrient Deficiency
 - Low DO Concentration
 - Low F/M
 - Excessive Grease and Oil (Thanksgiving!)
 - Low pH (<6)
 - Septicity (sulfides and organic acids)
- ***Only an indicator***, look at overall system as several issues can impact filamentous growth

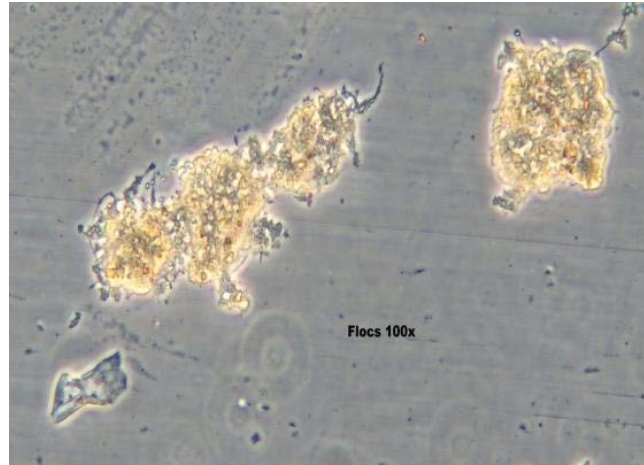
Filamentous Bacteria Ranking

- Several different ranking systems exist, Richard's, Eikelboom, etc.
- ***Typical classifications***
 - None to Few
 - Some
 - Common
 - Very Common (where operational issues can appear)
 - Abundant/Excessive

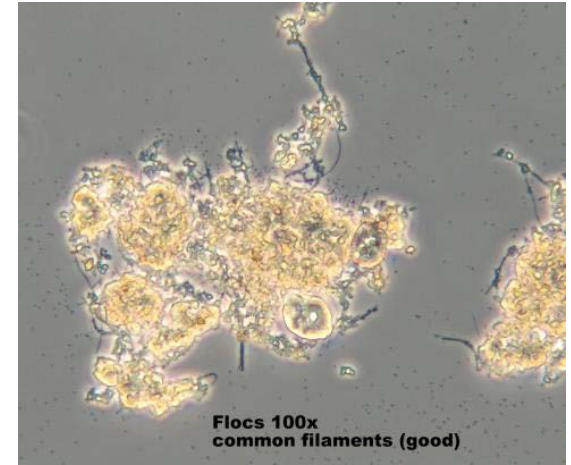
Filamentous Bacteria Ranking Examples



None to Few



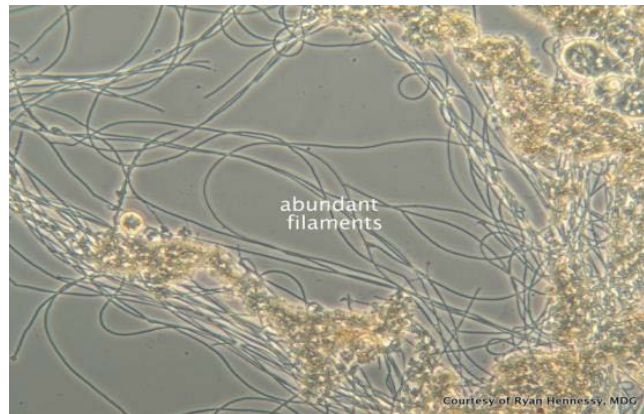
Some



Common



Very Common



Abundant



Excessive



Foam

- **Foam**- colors can be indicators of operational issues
 - White- system start up or possible excessive detergents in treatment waters



Foam Cont.

- Grey (ash)- excessive fines from recycled systems
- Brown- filamentous, also called Nocardia foam, others are Microthrix or type 1863



How can Probiotic Solutions help?

- ***Probiotic Solutions*** are proprietary products that help promote
 - Microbial health and diversity
 - Seattleability
 - Foam reduction/elimination
- ***Where to dose?***
 - Aeration basins
 - Oxidation ditches
 - Clarifiers
 - Directly on foam

References

- Wastewater Microscopy- City of Peoria, Matthew HagenSwiecicki
- Wastewater Microbiology- Microbial Discovery Group
- Handbook of Microscopic Examination of Sludge, 1983, Eikelboom, D.H. and Van Buijsen, H.J.J.



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Thank You
