FILAMENTOUS FOAMING

Figure 1: Brown filamentous foaming.

Foaming is a common occurrence at wastewater treatment plants and is often considered an operational nuisance. It can lead to loss of solids inventory, carryover of solids into the final treated effluent, clogging of gas lines and overflow in digesters. Foaming typically occurs on the surface of aerated tanks, clarifiers and digesters and can be caused by a range of reasons, i.e. low sludge age, detergents, toxicity, excess extracellular polymeric substance (EPS) production, and filamentous bacteria. This issue focuses on foaming caused by filamentous bacteria only which is characteristically dark brown in colour.

Foaming bacteria typically appear in a filamentous shape but do not need to be so to produce foam. They are heterotrophic meaning they consume organic substances as an energy source. Their foam producing capability is due to their physiology. They have a hydrophobic cell surface which has a similar structure to that of fats, oils and greases (FOG). Due to this, foaming bacteria are able to float on water surfaces and adhere to and consume hydrophobic substances such as FOG. This means that they in fact perform the useful function of gathering and consuming FOG in wastewater. Plants that have no foaming bacteria typically result in the carryover of some FOG to the final effluent.

It is therefore more useful to consider foaming management strategies where foaming is excessive and causing disruption to plant operation, rather than trying to eliminate all instances of foam.

Foaming bacteria are slow growing; therefore foaming issues have been a relatively recent problem in the history of wastewater treatment. The need for nutrient removal in wastewater treatment resulted in the need for longer sludge ages. Foaming bacteria typically need a sludge age of more than 10 days to take hold in the system which is often similar to that needed for the growth of nitrifying bacteria. This is why excessive wasting to “wash out” foaming bacteria is not always appropriate for resolving foaming as it risks the loss of nitrifying bacteria.

However foaming can also occur overnight in some circumstances. This is typically associated with aeration loss where a change in pH of the wastewater and a rise in denitrification rate shift the available nitrogen from nitrate ions to ammonia. This process triggers weakly hydrophobic bacteria to morph to strongly hydrophobic bacteria which can produce a shock foaming incidence.

Foaming best management practices:
- Removal of excess FOG via a DAF system or similar.
- Mechanical foam removal and baffle installation on aeration tanks to prevent carry over of foam from bioreactors to the clarifiers.
- Avoid recycling of foam back into the activated sludge process. No discharge of foam to anaerobic digesters, aerobic digesters are typically okay.

Measures to avoid:
- Excessive wasting – some increased wasting can help, too much wasting can risk washing out nitrifiers.
- Selectors – selectors are useful for filamentous bacteria control but not always for foaming bacteria.
- RAS chlorination – only to be used in the worst case scenarios. The amount of chlorine required to deactivate foaming bacteria can have an adverse effect on the rest of the biomass.

Figure 2: Typical foaming bacteria Nocardia and M. Parvicella.

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