G-bacteria dominate wastewater treatment plants

“G-bacteria” are organisms able to assimilate carbon in excess of their growth requirements and store it as intracellular glycogen (Figure 1). Whilst these organisms share physiological traits they are phylogenetically diverse (Figure 2). Surveys of winery wastewater treatment plants (WWTP) in peak Vintage 2014 and 2015 showed the common occurrence of these organisms in Australian WWTP. Some consider the G-bacteria beneficial as they are able to remove large concentrations of COD from the systems (Kiss et al., 2011). However, our experience indicates that these organisms are associated with bulking sludge with sludge volumes (SV) in the range of 90-98%, resulting in decanting water with high suspended solids, high turbidity and consequently high COD.

Methodology

Light microscopy combined with staining was used to examine and characterise sludge samples (Figure 1 and Figure 3). Fluorescence in situ hybridisation (FISH) was then performed on samples containing G-bacteria for their precise identification and quantification. Sludge volumes and turbidity of activated sludge samples were determined.

Impact

G-bacteria related to the Actinobacteria, Alphaproteobacteria and Gammaproteobacteria (Figure 2) have all been observed. FISH identified Alphaproteobacterial Defluvicoccus Cluster II as the most common, with populations in abundance at 60% (Figure 4). When these organisms were dominant, sludge volumes of 980ml/L and turbidity of 100NTU (Figure 5) were commonly observed. Suggesting the proliferation of these organisms is problematic for WWTP.

Investigating solutions

Whilst these organisms are beneficial in their ability to assimilate high levels of carbon, their tendency to cause poor settling and turbid effluent is problematic. We conclude that Defluvicoccus should be considered a common population within winery wastewater treatment, their population should be monitored and controlled so they do not heavily dominate. This research generated more questions than answers;

Why do some G-bacteria remain in the floc and cause bulking?

Why do others separate from the floc and cause turbidity?

Is there an abundance threshold, when these problem solvers turn problematic?

Further investigations are currently underway examining these issues.

References