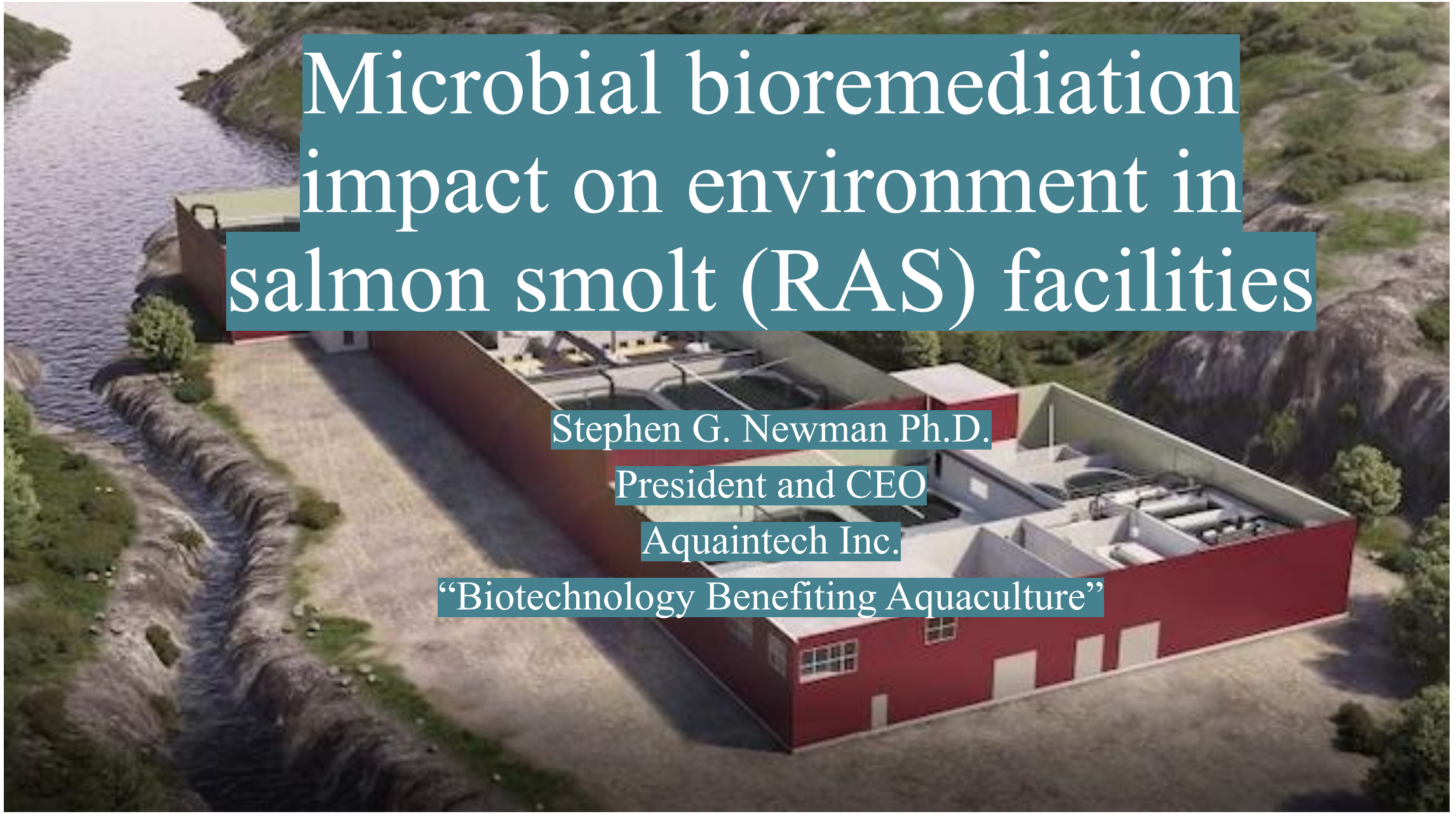

Microbial bioremediation impact on environment in salmon smolt (RAS) facilities

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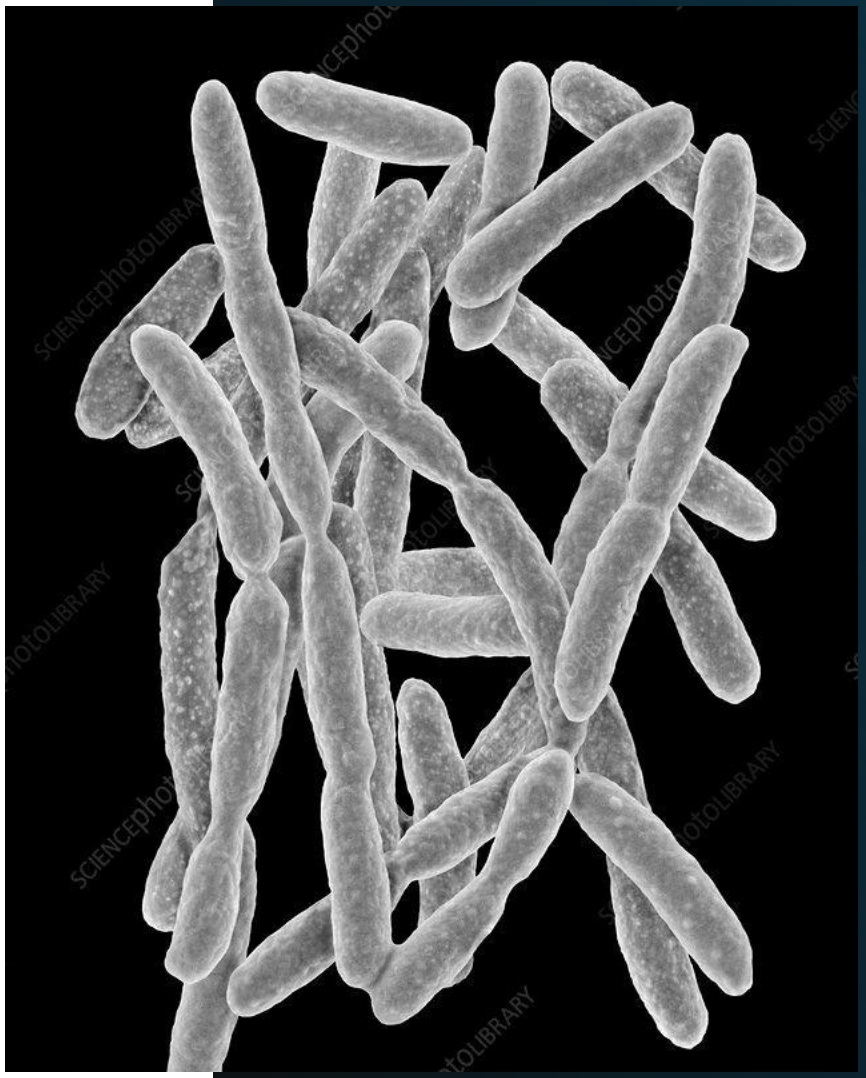
"Biotechnology Benefiting Aquaculture"

The challenge

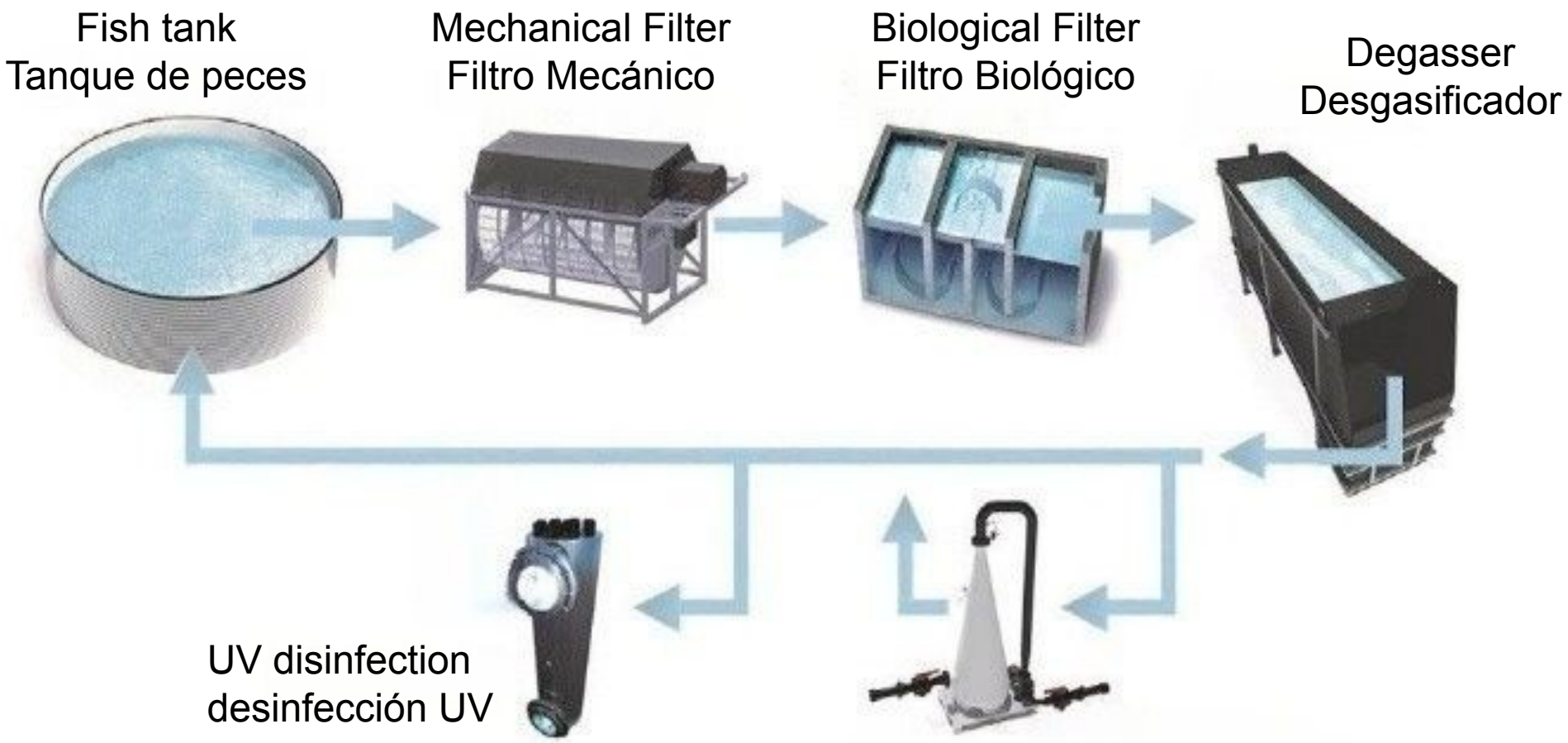
- The microbiome in the environment of salmon (smolt production) culture facilities is complex and can lead to animal health challenges.
- Flavobacteria, gram negative rods, including strains of *F. psycrophila* and *F. columnare* are opportunistic pathogens that impact salmon smolts.
- They are often secondary to disease caused by *Piscirickettsia salmonis*.
- These together account for 40 to 90% of the total observed mortality noted in salmon smolt production facilities.
- These can carry over into net pens.



Typical lesion appearance

Where to use the tablets?

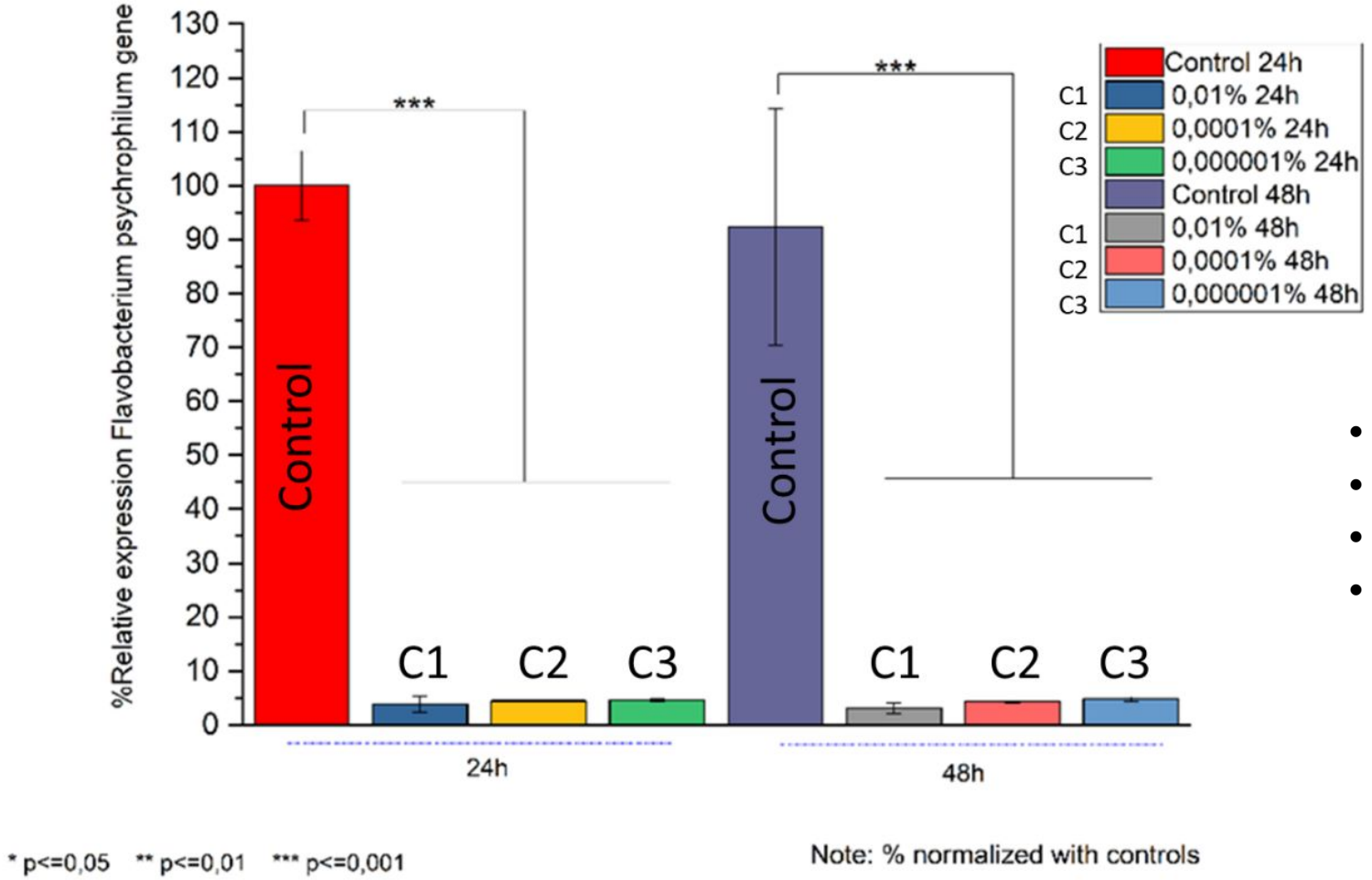
Add directly to the biological filter



10 gram tablets

- One tablet per 10 MTs of water added daily to the biofilter

Impact of Bacillus sp. on Flavobacterium levels



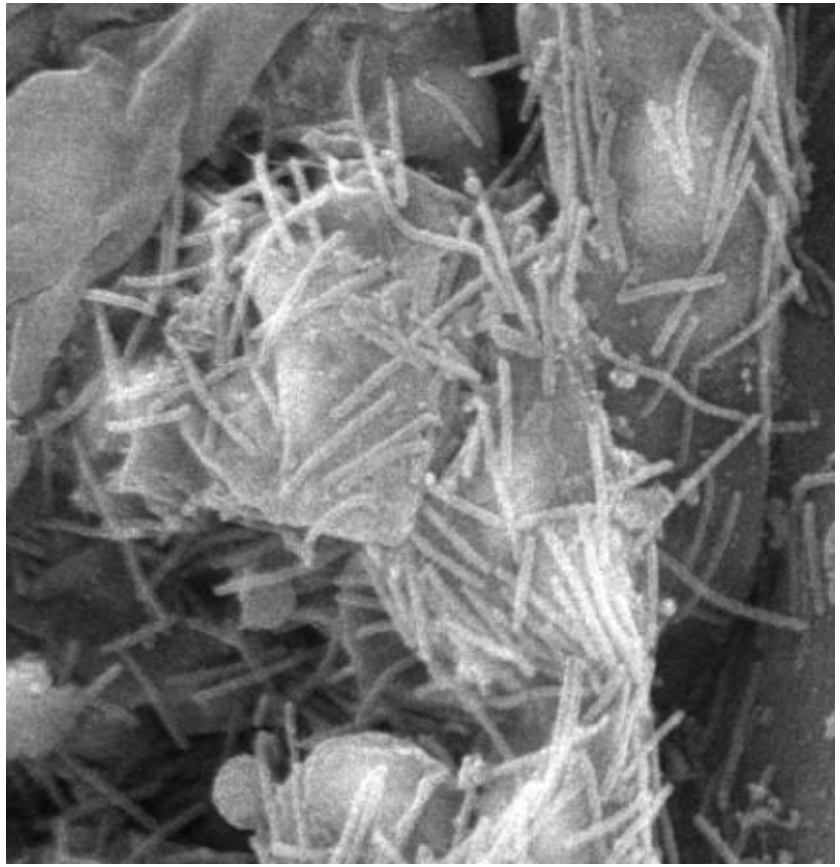
* p<=0,05 ** p<=0,01 *** p<=0,001

Note: % normalized with controls

- 95% reduction of CFUs
- Even very low levels were effective
- Impact was consistent over time
- The Bacillus strains present in our tablets inhibit the growth of flavobacteria.

Results summary

- Tablets are an effective tool for reducing the impact of Flavobacterium species.
- For RAS systems the tablets can be applied to the biofilters simply by dropping them in.
- The bacteria colonize the system, and it has been shown that they are effective at relative low levels.
- However, since no two systems are identical, we suggest that you start at 1 ppm. This is 1 mg/liter or 1 gram per 1000 liters, 10 grams per 10000 liters.
- They should be added daily to ensure optimum efficiency as this colonization is likely short lived.



Important Notes

- The bacteria in the tablets are harmless environmental isolates in the form of spores.
- These spores are a non vegetative form of a facultatively aerobic group of bacteria, the Bacillus genus.
- They work by altering the microbiome although they can have other benign impacts.
- They cannot harm the animals although improper use can cause changes in the microbiome of the system that could, in theory, negatively impact the animals.
- When used as suggested, the only impacts should be an alteration in the types of bacteria present.
- These bacteria are widely used in shrimp farming for bioremediation of shrimp sediment accumulation.