

Case Study - Malatech Bioaugmentation

1 000 m³/d Municipal Wastewater Treatment Plant of a city

Goals of bioaugmentation:

Reducing Total Nitrogen concentration in the final effluent, and OPEX reduction by lowering energy consumption, polyelectrolyte usage, excess sludge dewatering, transportation and disposal costs, Ferric(III)Chloride usage.

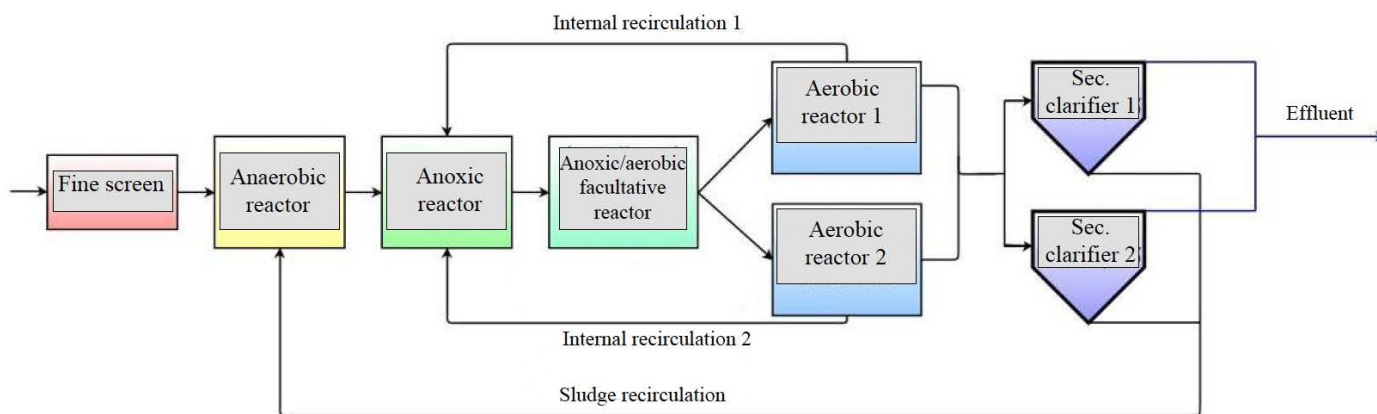


Author: Malatech Water Ltd.

Title: Municipal wastewater treatment plant optimization

Operator has operated this municipal WWTP without any issues for 10 years after its renovation. The plant has had no violations for effluent quality throughout the years. The reason operator has opted to apply Malatech Bioaugmentation was that the authorities issued stricter effluent TN concentration limit, which the biology was unable to keep safely since the influent TN is historically very high here (80-180 mg/l). OPEX reduction in terms of chemical usage, excess sludge production, and energy consumption was a secondary but still important KPI.

The plant is equipped with complete (N,P) nutrient removal, and designed well for the influent cumulative load. The secondary clarifiers are also well-constructed and -designed Dorr types for handling the hydraulic load.



Schematic view

Effluent requirement for TP is strict since the receiver freshwater is located in a sensitive natural area, so the operator has to add Ferric salt for TP removal since Bio-P itself is unable to provide the strict effluent limit safely.

We have targeted the following achievements with Bioclean TM treatment:

- TN reduction to meet the 10 mg/l effluent requirement safely
- Reducing energy consumption, since the blowers are equipped with frequency controller
- Reducing excess sludge production
- Reducing Ferric salt usage significantly by boosting Bio-P removal step.

Dosages:

Bioclean TM as our core technology has only been applied since the plant ran trouble-free. We just needed to extract the most from its biology by Bioclean TM, which has a diverse portfolio of benefits making it a sole solution for the operator's challenges.

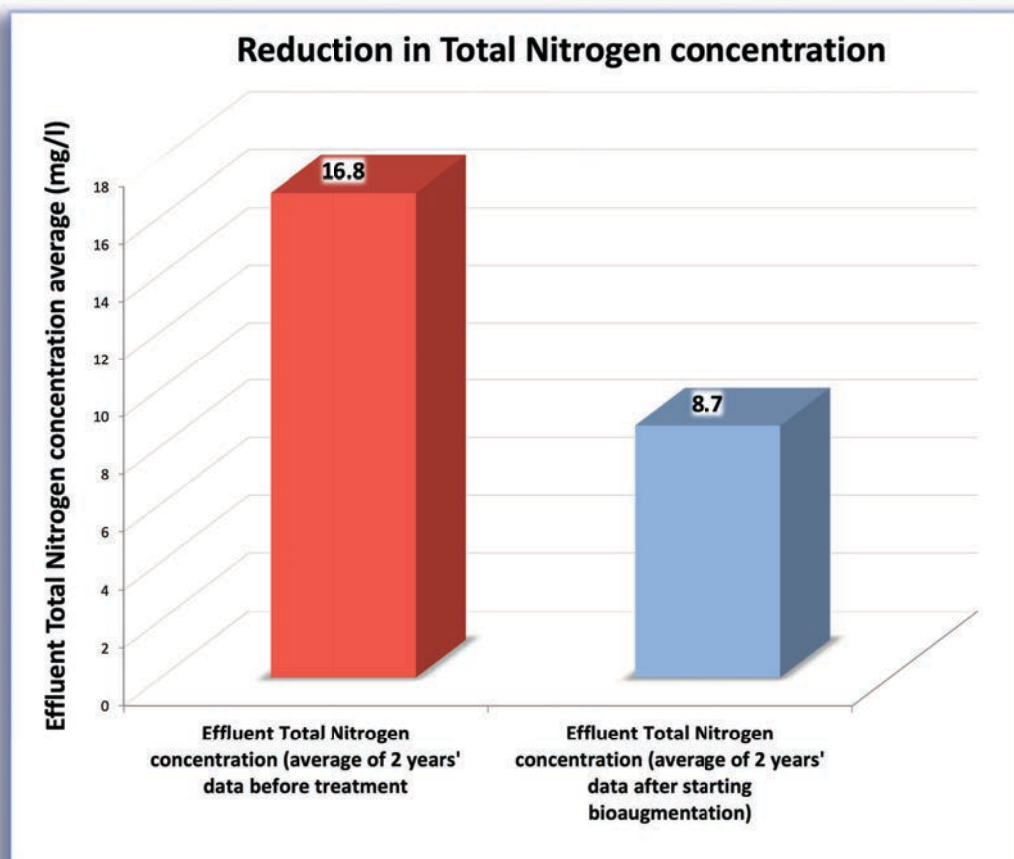
The shock dosage was 4 kg/d on week 1, followed by 3 kg/d on week 2, then 1 kg/d on week 3, and 1 kg/d on week 4. The maintenance dosage was 0.5 kg/d, dosed into the raw influent after pretreatment.

Results:

Nutrient Removal:

Total Nitrogen removal:

Bioclean TM has a massive impact on denitrification, it boosts Nitrogen removal both in anoxic, as well as in the aerobic reactors by its unique microbes with high simultaneous nitrification-denitrification (SND) capabilities. By enhancing the floc structure, the more compact, better settling, dense flocs are able to carry out intrafloc denitrification more efficiently in the aerobic reactors. The combination of the 2 processes results a significant drop in effluent Total Nitrogen concentration at every Bioclean TM bioaugmented plants. As the result shows, **we have massively decreased effluent TN compared to the reference period**. Influent TN remained at the same level before, and during bioaugmentation, we managed to bring down TN in effluent below 10 mg/l:

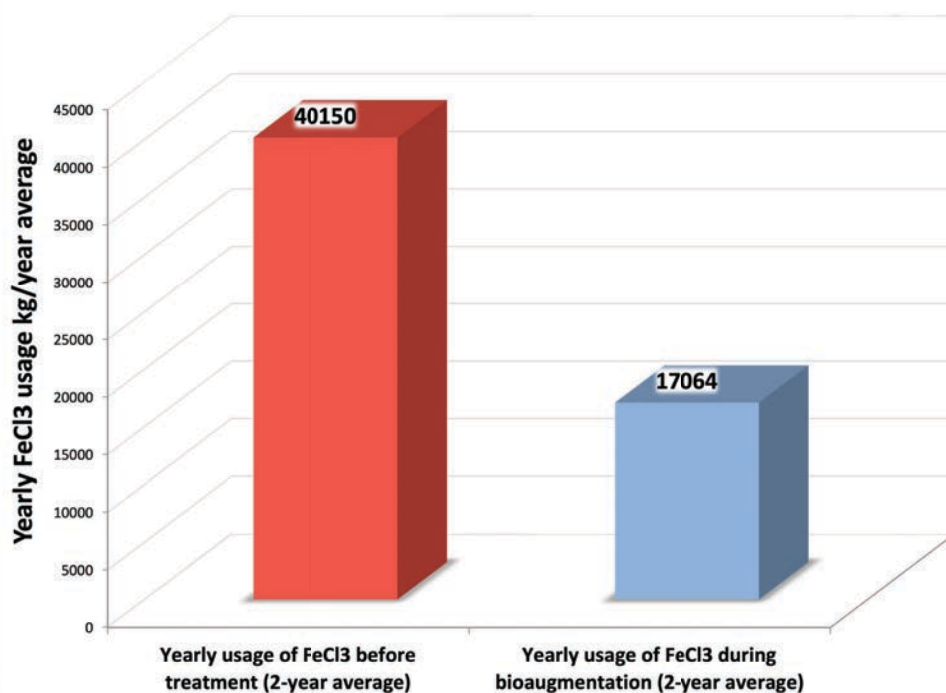


Total Phosphorus removal:

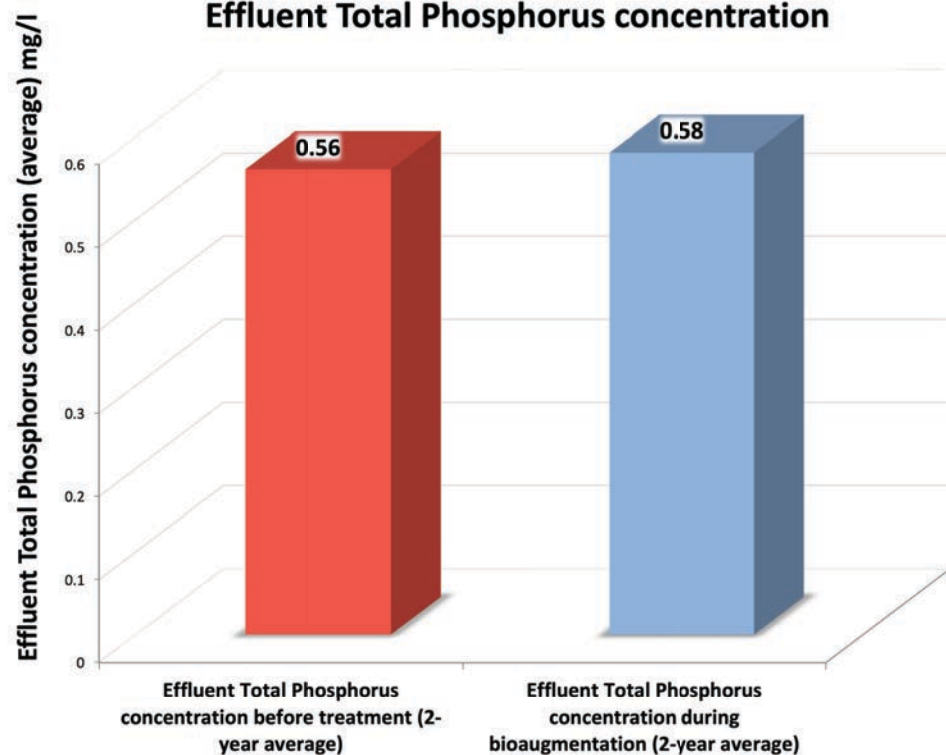
The complex Bioclean TM solution's other key strength could also be demonstrated: massive enhancement of Biological Phosphorus removal. **Bioclean TM has a decent positive impact on both poly-Phosphate formation, and excess Phosphate uptake.**

The TP concentration in the influent varies between 15-23 mg/l. The plant has consumed more than 40 tons of Fe(III)Cl₃ on a yearly average before treatment to keep effluent TP below 0.7 mg/l. After we started Bioclean TM treatment, the operator gradually lowered Ferric salt dosage. After 4 month of treatment the Ferric salt consumption fell less than the half of the reference period while keeping effluent TP between 0.5-0.6 mg/l.

Reduction of FeCl₃ usage



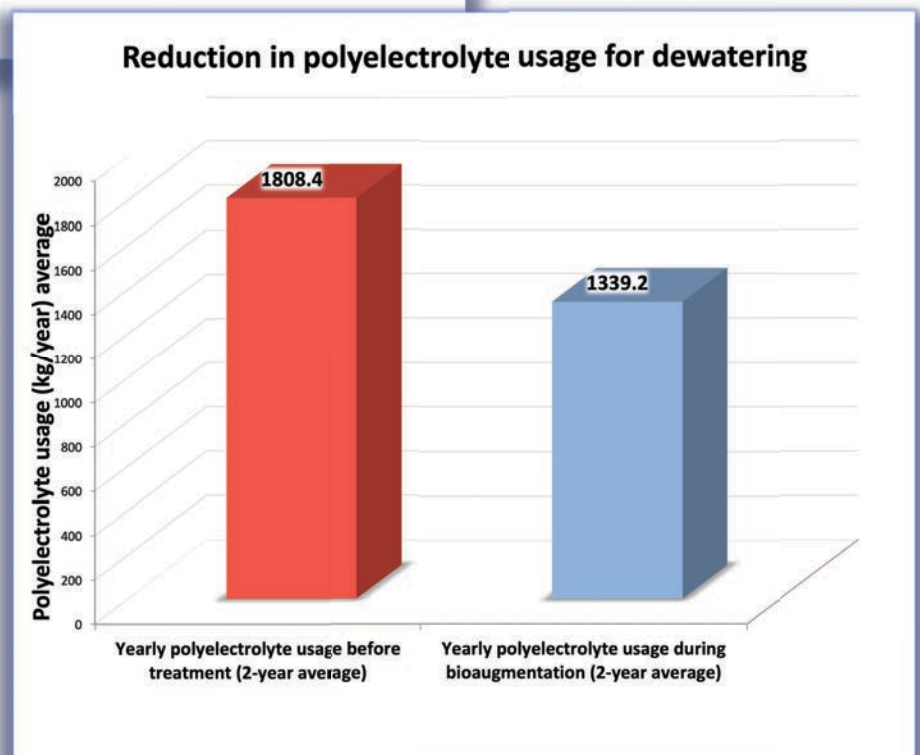
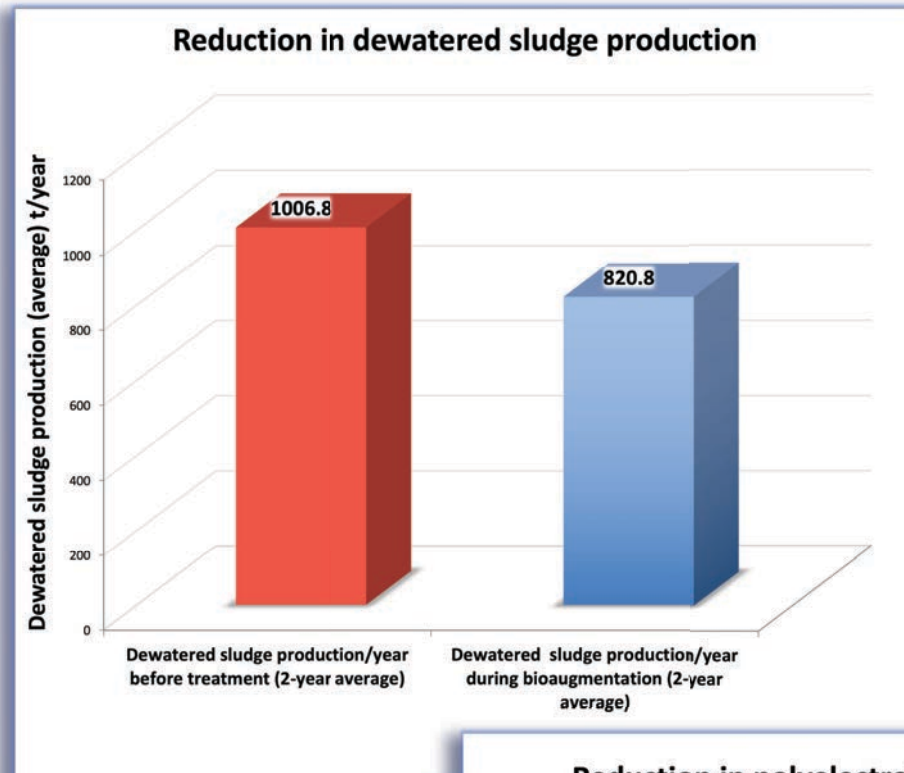
Effluent Total Phosphorus concentration



Savings on operating costs:

Dewatered sludge production:

Bioclean TM also has a mentionable impact on excess sludge production. **While reducing the yield of the activated sludge bacteria, operators of WWTP's naturally experience a drop in the monthly dewatered sludge production** which is another major factor of cost-savings for bioaugmentation with Bioclean TM, since sludge dewatering, transportation, and disposal costs become less.



Energy consumption:

Bioclean TM bioaugmentation has a natural effect on DO utilization ability of the activated sludge. As the plant is equipped with precise DO control, the average operating frequency of the blowers dropped after the start of Bioclean TM dosage which resulted significant energy savings as shown below. 2-year average data before treatment have been compared to 2-year data of bioaugmentation, while the daily cumulative load has remained nearly the same.

