

Case Study - Malatech Bioaugmentation

1 500 - 2 500 m³/d Seasonal Food Processing Wastewater Treatment Plant (Cannery)

Goals of bioaugmentation:

Operator set up multiple goals for the bioaugmentation treatment:

1. OPEX reduction on energy consumption, excess sludge dewatering, transportation, and disposal, chemical usage for polyelectrolyte and Ferric(III) Chloride
2. Less fluctuations in the effluent at start-up phase, as well as at campaign shifts
3. The cannery's operation is seasonal with different campaigns going through the year from March till November. The practice was to empty the reactors in November, dewater, transport, and dispose the activated sludge, and start up again in March by inoculating them with fresh activated sludge imported from the city's local municipal wastewater treatment plant. Operator wanted to avoid this massive cost, and opted to save the activated sludge for 4-5 months by keeping it alive to be able to start the process with safety in March for the bean season.



Author: Malatech Water Ltd.

Title: Food processing industrial wastewater treatment plant optimization

The client is an international company, among the world leaders in manufacturing high-end canned and frozen vegetables. The factories produce canned vegetables, frozen vegetables, processed fresh vegetables, prepared vegetables.

The subject factory's wastewater treatment plant has been using our bioaugmentation products (**Bioclean TM, BioBooster Micro, Bioclean ALPHA**) for many years to improve the treatment efficiency of the activated sludge, and to reduce operating costs.

The biological wastewater treatment plant consists of a **UASB anaerobic reactor, followed by continuous flow anoxic, and aerobic activated sludge reactors.** The WWTP's hydraulic peak comes at the pea-processing season at 1 600 - 2 500 m³/d, while the cumulative load peaks at the corn season with a COD up to 25 000 mg/l entering the UASB. **Bioaugmentation is applied for the UASB (BioBooster Micro), and for the activated sludge as well (Bioclean TM, Bioclean ALPHA-BioBooster Micro).**

UASB only operates in pea and corn seasons from early June till late September. BioBooster Micro is added with a 2 kg/d dosage into UASB inlet.

Start-up is done in March for the activated sludge plant with Bioclean TM 8-6-4-3 kg/day dosages for the first 4 weeks, while Bioclean ALPHA and BioBooster Micro's common solution is dosed 4-4 kgs/week for the first 2 weeks.

Maintenance dosages are 0.5 kg/d for Bioclean TM, and 2-2 kgs/week for Bioclean ALPHA and BioBooster Micro. Dosages temporary increase to double in case of seasonal shifts, and at high loads for a few days.

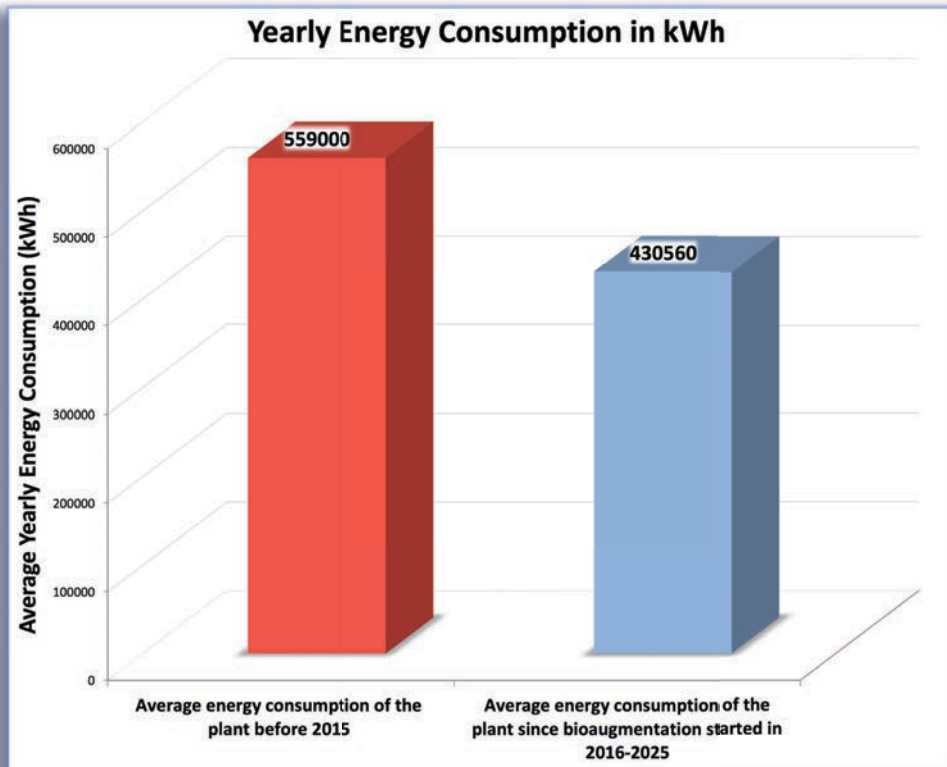
The activated sludge is kept alive throughout the 4-5 months of shutdown by applying temporary aeration periods, and **Vickzyme treatment** with 12 kgs/week.

Results:

1. Operating costs show a significant reduction despite the cumulative load has increased in the past 10 years of bioaugmentation treatment.

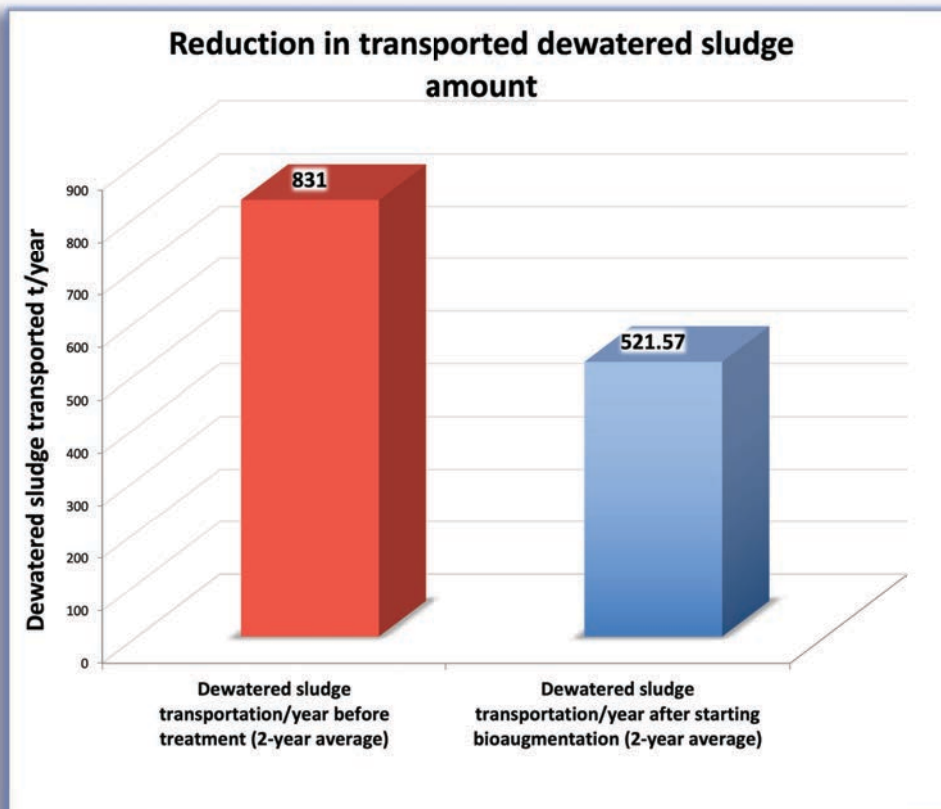
Energy consumption:

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. Operator did not modify the preferred DO values in the SCADA.



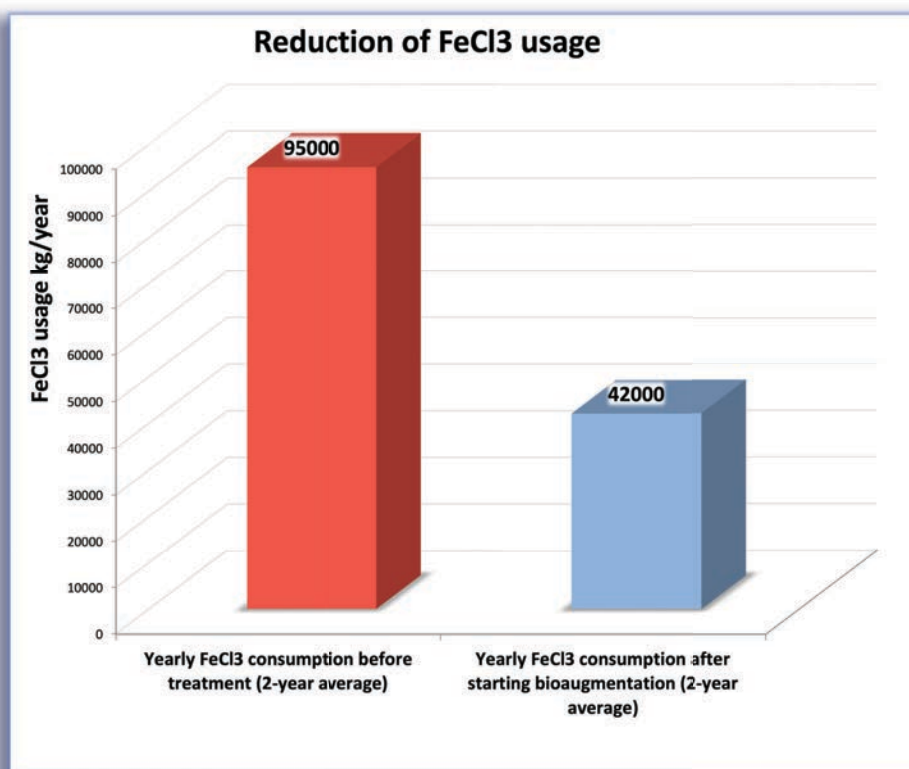
Dewatered sludge production:

Bioclean TM, and Bioclean ALPHA also have 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 and Bioclean ALPHA.



Ferric(III) Chloride dosage:

The operator doses FeCl₃ (41 m/m%) for TP removal. Bioclean TM improved TN removal rate with a massive extent, which provided the possibility for the customer to divide the pre-anoxic basin with our technological assistance: the first part has been transformed into a Bio-P reactor, receiving the raw inlet + recirculated sludge from the clarifiers. The second part remained anoxic receiving the Bio-P outlet + nitrate recirculation from the end of aerobic reactors of both lines. This modification resulted that in the low-load bean season the FeCl₃ dosage is 0, while in the pea and corn season, FeCl₃ usage is also significantly reduced despite the Bio-P is unavailable then (becomes anoxic due to the high load, too low HRT, and Nitrate rich sludge recirculation).



2. Stabilization of fluctuating nitrification, and denitrification:

The treatment technology with the UASB + AX-AE activated sludge reactors + a post-treatment DAF is well-designed to handle the cumulative load, which means the factory never had effluent violations in the past. The start-up phase in March, as well as the seasonal shifts between the bean-pea seasons including the start-up of the UASB result a slight disturbance in nitrification. NH₄-N values rise temporarily in the effluent for a few days, which is followed by a nitrate accumulation since denitrification is unable to follow up the quick shifts in nitrification. In these periods TN in effluent rises mainly because of high Nitrate concentration. In the past 10 years during Malatech Bioaugmentation treatment, the peaks have been reduced, as well as the duration of instability as follows:

	Peak concentration for the reference years before bioaugmentation (2010-2015)	Peak concentration during bioaugmentation (2016-2025)
NO ₃ -N:	46.00 mg/l	16.00 mg/l
NH ₄ -N:	8.84 mg/l	2.24 mg/l

Yearly average duration of fluctuations in nitrification before bioaugmentation:	22 days
Yearly average duration of fluctuations in nitrification during bioaugmentation:	2 days
Yearly average duration of fluctuations in denitrification before bioaugmentation:	38 days
Yearly average duration of fluctuations in denitrification during bioaugmentation:	7 days

3. No need for draining after season, and refill with imported sludge at start-up

Using Vickzyme's capabilities, the operator managed to spare a decent amount of costs by keeping the activated sludge alive in the 4-5 month-long off-season when there is no inlet raw wastewater to the WWTP. The operator turned off recirculation pumps at the end of each season. Secondary clarification is done in the final reactors periodically; both are equipped with submerged aeration. Operator has established periodic aeration times in the entire stagnant system, and dosed 12 kgs of Vickzyme once a week, proportionally distributed between the reactors based on their volume till the start-up in March.

Vickzyme helped to hydrolize and degrade the non-bacterial TSS part of the activated sludge flocs to provide a food source for the living bacteria in this nearly dormant state. Besides it helped to hydrolize dead cells which served also as food source for surviving bacteria. For the season start in March, the operator had an activated sludge with a very high active bacterial content, low inactive content. Also Vickzyme lowered MLSS from 9 000 mg/l to 2 500 mg/l, which resulted a moderate sludge removal for the entire bean season onwards.

After 4-5 months the operator started up with bean season without any treatment issues even on the 1st day. All biological processes were operating with peak performance from Day 1, while enormous amount of cost has been saved on draining, dewatering, transportation, disposal, then importing fresh sludge, like operator did in the past before bioaugmentation.