

Case Study - Malatech Bioaugmentation

1 200 - 1800 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 Ferric(III) Chloride
2. Less fluctuations in the effluent at start-up phase, as well as at campaign shifts



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Title: Food processing industrial wastewater treatment plant optimization

The client is an international company with French origin, among the world leaders in manufacturing high-end canned and frozen vegetables. The factories produce canned vegetables, frozen vegetables, processed fresh vegetables, prepared vegetables made of pea, and corn.

The bioreactors are kept empty for most of the year, after importing excess sludge from a nearby municipal WWTP in late May, the pea season starts. Around mid-July the production switches to corn processing, which lasts till mid-September. After the corn season is finished, the reactors are drained, the sludge content is thickened, dewatered, transported, and disposed. 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 1 500 - 1 800 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).**

The factory's wastewater treatment plant has been using our bioaugmentation products (**Bioclean TM, BioBooster Micro, Bioclean ALPHA**) since 2016 to improve the treatment efficiency of the activated sludge, and to reduce operating costs. BioBooster Micro is added with a 2 kg/d dosage into UASB inlet right after factory production starts.

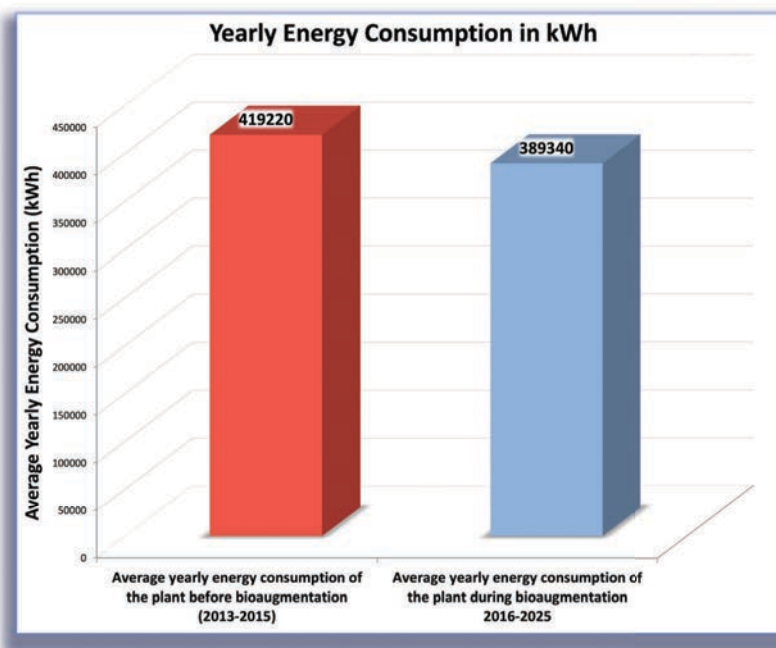
On the activated sludge part, shock dose is done in late May, as the production starts, and reactors are filled with sludge with Bioclean TM 5-3-2-1 kg/day dosages for the first 4 weeks, while Bioclean ALPHA and BioBooster Micro's common solution is dosed 3-3 kgs/week for the first 2 weeks. Maintenance dosages are 0.5 kg/d for Bioclean TM, and 2-2 kgs/week for Bioclean ALPHA and BioBooster Micro.

Results:

1. Operating costs show a significant reduction in the past 10 years of bioaugmentation treatment.

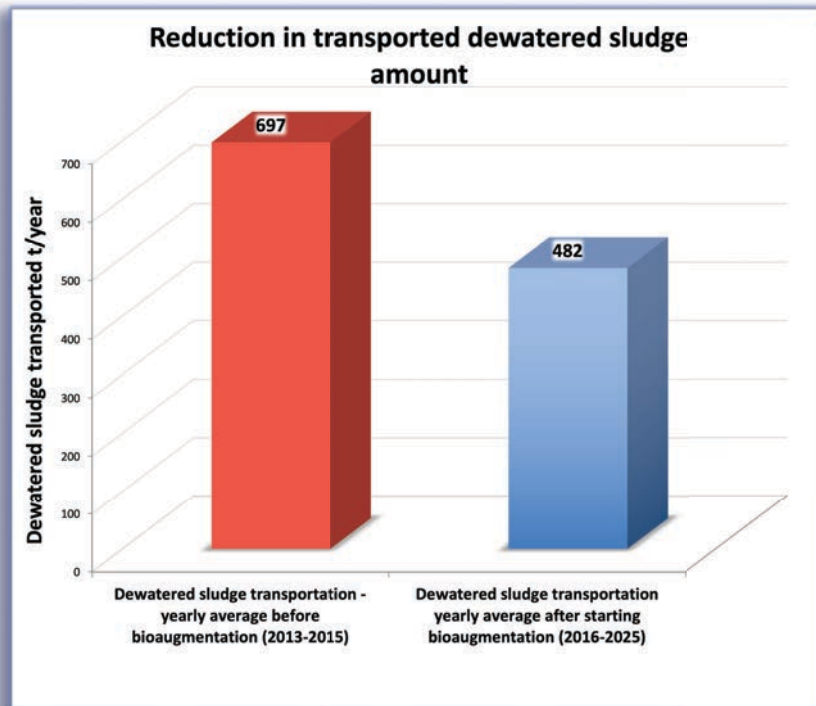
Energy consumption:

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.



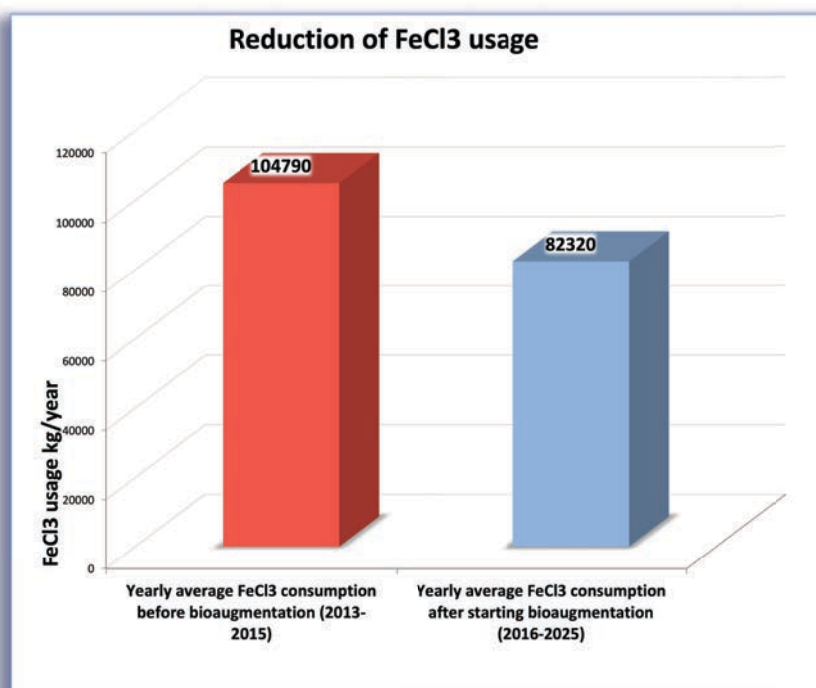
Dewatered sludge production:

Bioclean TM & ALPHA also has a mentionable impact on excess sludge production. While reducing the yield of the activated sludge bacteria, operators of WWTPs naturally experience a drop in the yearly dewatered sludge production which is another major factor of cost-savings by bioaugmentation.



Ferric(III) Chloride dosage:

The operator doses FeCl_3 (41 m/m%) for TP removal. The enhanced nutrient uptake ability provided by Bioclean TM and Bioclean ALPHA reduces the need of metal salts, while further reducing TP in the effluent.



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 in May with the pea season includes the start-up of the UASB which results a disturbance in nitrification. The pre-treated raw wastewater goes through the UASB with high hydraulic load, and washing out the dormant UASB water with high NH₄-N concentration. The anaerobically pretreated water after stagnation contains high concentration of fatty acids, and alcohols besides NH₄-N, which cause trouble for the nitrifiers. The activated sludge from a nearby municipal plant used for inoculation receives the inhibitory load, then immediately a high cumulative load from pea processing. It has had a several-week-long adaptation time every year, and the effluent parameters, especially NH₄-N, and TN fluctuated during this period. NH₄-N values rose 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 eliminated at all, both NH₄-N, and TN is kept below regulatory limits even from Day 1:

	Peak concentration for the reference years before bioaugmentation (2010-2015)	Peak concentration during bioaugmentation (2016-2025)
TN:	104.00 mg/l	42.00 mg/l
NH4-N:	13.30 mg/l	1.72 mg/l
Yearly average duration of fluctuations in nitrification before bioaugmentation:	20 days	
Yearly average duration of fluctuations in nitrification during bioaugmentation:	0 day	
Yearly average duration of fluctuations in denitrification before bioaugmentation:	31 days	
Yearly average duration of fluctuations in denitrification during bioaugmentation:	0 day	