Malatech Water Trading & Service, Ltd.
Address: 1/E Vanyi way, Alsonemedi, 2351 Hungary • Telephone: +36 30 377 8089
E-mail: info@malatechwater.com • Web: www.malatechwater.com

Case Study - Malatech Bioaugmentation

1 100 m3/d Municipal Wastewater Treatment Plant of a city

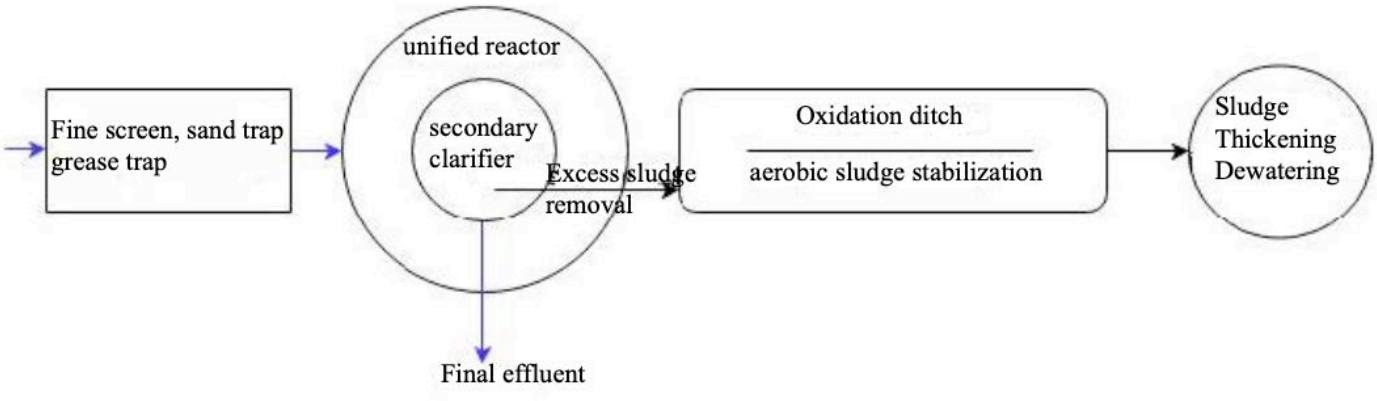
Goals of bioaugmentation:

OPEX reduction by lowering energy consumption, polyelectrolyte usage, excess sludge dewatering, transportation and disposal costs, lowering environmental fees for further decreasing COD, Total Nitrogen, and Total Phosphorus concentrations in the final effluent

Author: Malatech Water Ltd.

Title: Municipal wastewater treatment plant optimization

The municipal WWTP operator client has had this **trouble-free plant** in operation 7 years after renovation. The plant has a unified circular activated sludge reactor after pretreatment. The unified zone has pre-anoxic and aerobic sections. The separation of the solids happens in the secondary clarifier in the middle, recirculated sludge from here goes to pre-anoxic, while excess sludge is removed to an old oxidation ditch, where aerobic sludge stabilization happens. After stabilization, sludge is thickened, and dewatered.



Schematic view

Phosphorus removal does not require Ferric salt addition since authority limit is high (5 mg/l), the plant is not in an environmentally sensitive location. The P-uptake of the biology is sufficient to keep TP well below 5 mg/l.

Authority requirement for Total Nitrogen is 25 mg/l for the final effluent while 75 mg/l for COD, and 25 mg/l for BOD. The plant is well-designed for its cumulative load, and never had effluent violations.

Our focus was totally on OPEX reduction. We have targeted the following for operating cost savings:

1. Lowering the **energy consumption** of the plant
2. Since the plant is equipped with aerobic sludge stabilization for excess sludge where the HRT is high, we wanted to go for the maximum with a sole Bioclean TM treatment in terms of **dewatered sludge production reduction**. Bioclean TM has a unique capability in hydrolyzing the particulate matter, and boost total oxidation in such conditions. Decreasing excess sludge production means massive savings on polyelectrolyte costs used for dewatering, dewatered sludge transportation, and disposal costs.
3. In EU WWTP's are charged after COD, TN, TP release (kg/year), even if they are below the authority limity. Operator wanted to **reduce the environmental fees** as well, as much as possible.

Dosages:

Bioclean TM as our core technology has only been applied since the plant ran trouble-free, just we 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.

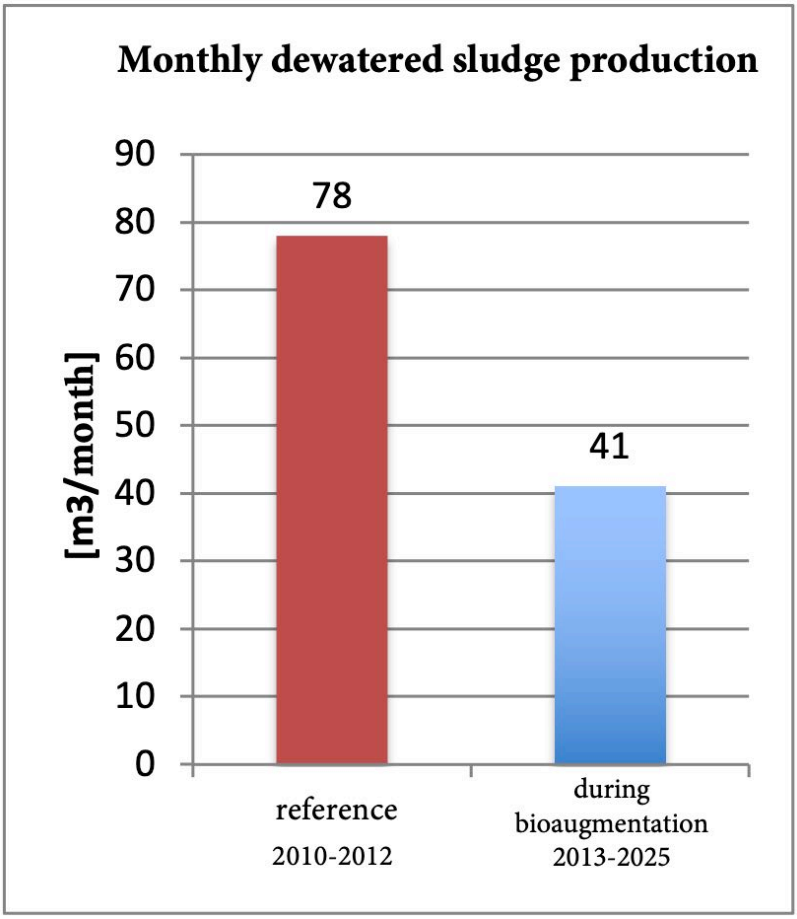
The shock dosage was 4 kg/d on week 1, followed by 3 kg/d on week 2, then 1 kg/d on week 3, and 1 kg/d on week 4. The maintenance dosage was 0.5 kg/d, dosed into the raw influent after pretreatment.

Results:

Savings on operating costs:

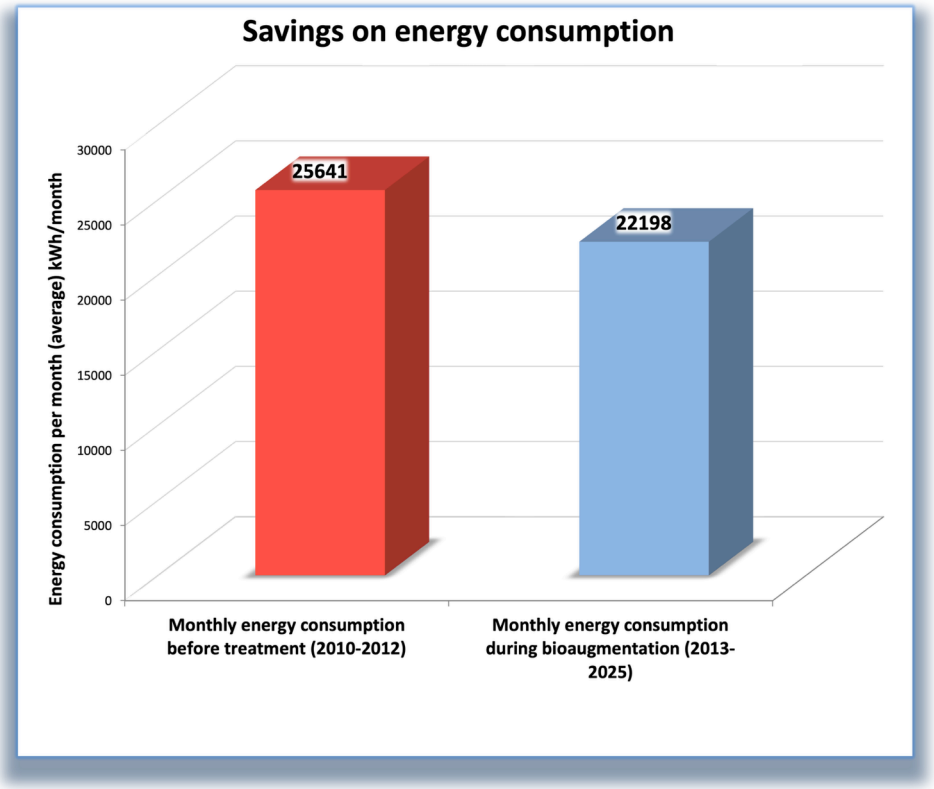
Dewatered sludge production:

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. For plants like this one, which are **equipped with aerobic sludge stabilization step with long HRT (10-14 days in this case), Bioclean TM has a serious impact on total oxidation by an improved hydrolytic rate of the dead cells, and hardly biodegradable TSS**. Usually, aerobic stabilization means that just by a Bioclean TM bioaugmentation, dewatered **sludge production can be lowered by 35-50%** with the same cumulative load for the bioaugmented period that it was for the untreated control period.



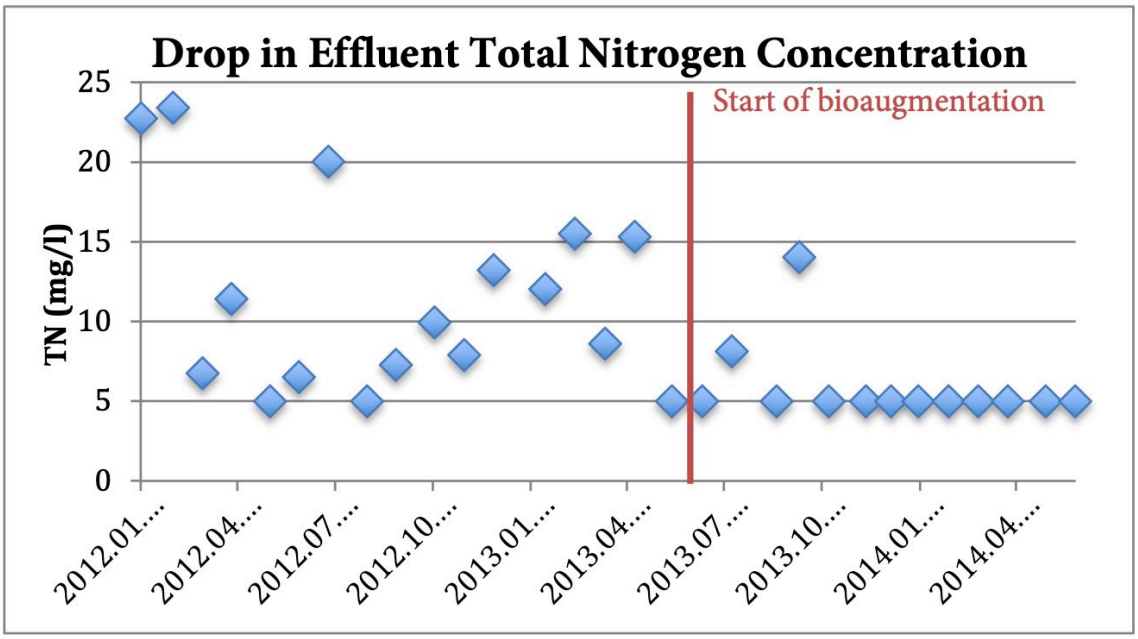
Energy consumption:

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. 3-year average data before treatment have been compared to 12-year data of bioaugmentation, while the daily cumulative load has remained nearly the same.



Total Nitrogen removal:

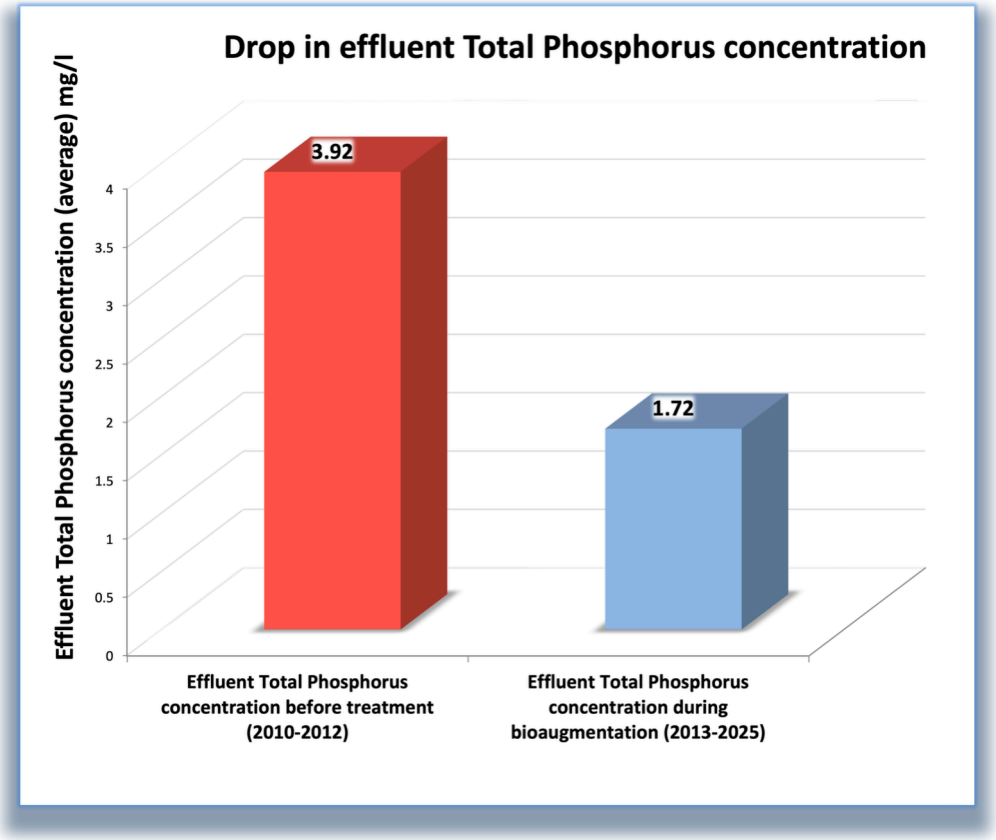
Bioclean TM has a massive impact on denitrification, it boosts Nitrogen removal both in anoxic, as well as in the aerobic reactors by its unique microbes with high simultaneous nitrification-denitrification (SND) capabilities. By enhancing the floc structure, the more compact, better settling, dense 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, 64-78 mg/l in average. 5 mg/l is the detection limit for the lab measurement of the operator's own accredited lab, on the chart below data shown as 5 mg/l means below 5 mg/l in reality.



Total Phosphorus removal:

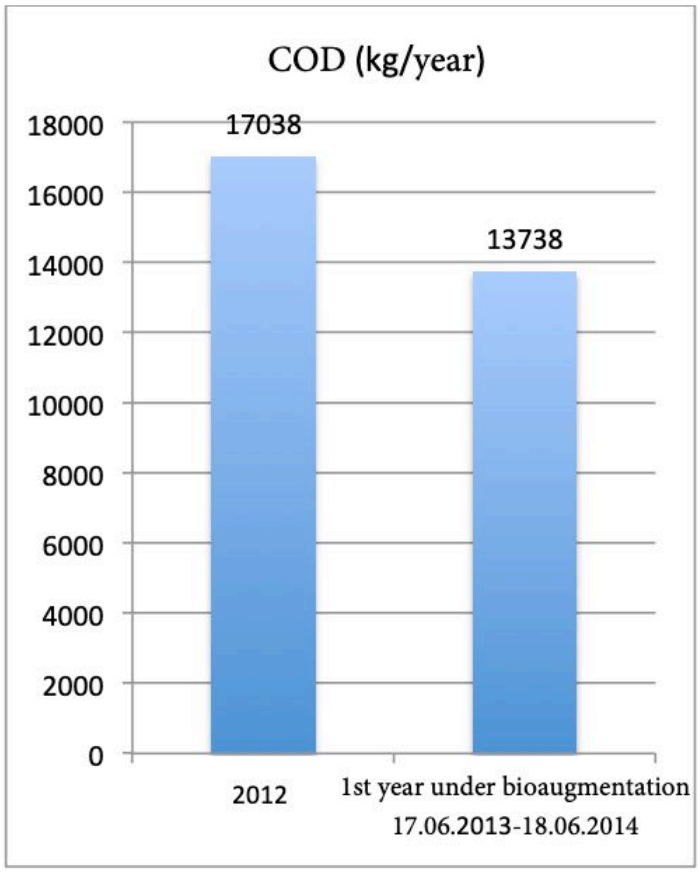
The complex Bioclean TM solution's other key strength could also be demonstrated: massive enhancement of Biological Phosphorus removal. **Bioclean TM has a decent positive impact on both poly-Phosphate formation, and excess Phosphate uptake**. Although the plant is not equipped with Bio-P reactor(s), the extremely low concentration of Nitrate in the recirculated sludge meant that the anoxic reactor was able to be used partly as a Bio-P reactor since Nitrate or DO as terminal electron acceptors were not present at most of the anoxic reactor volume during anoxic HRT. Bioclean TM also improves natural P-utilization in the biomass, which further reduces effluent TP values.

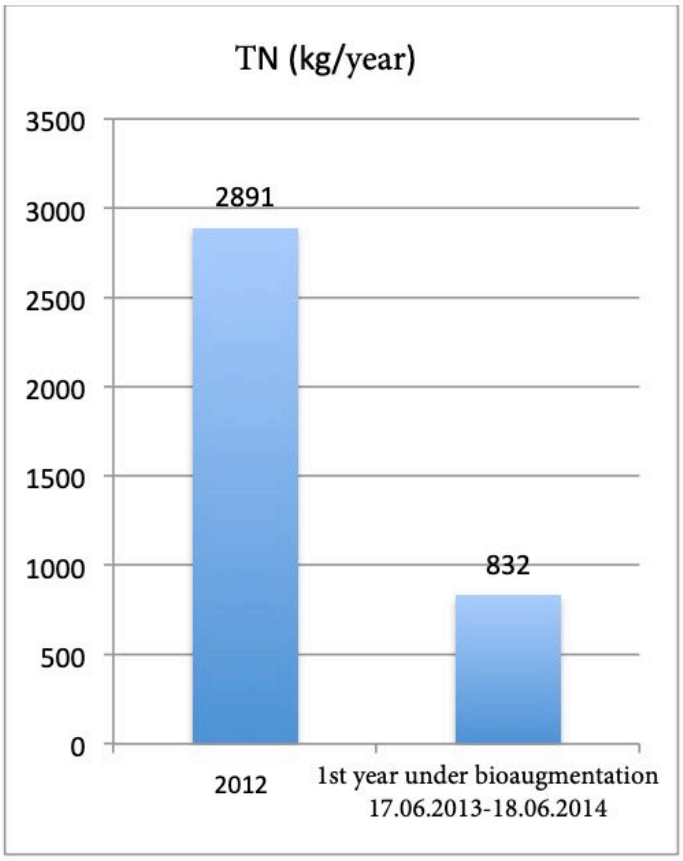
Technically the 12-16 mg/l influent TP teams up with 1-2 mg/l effluent without Bio-P reactor(s) or any metal salt addition.

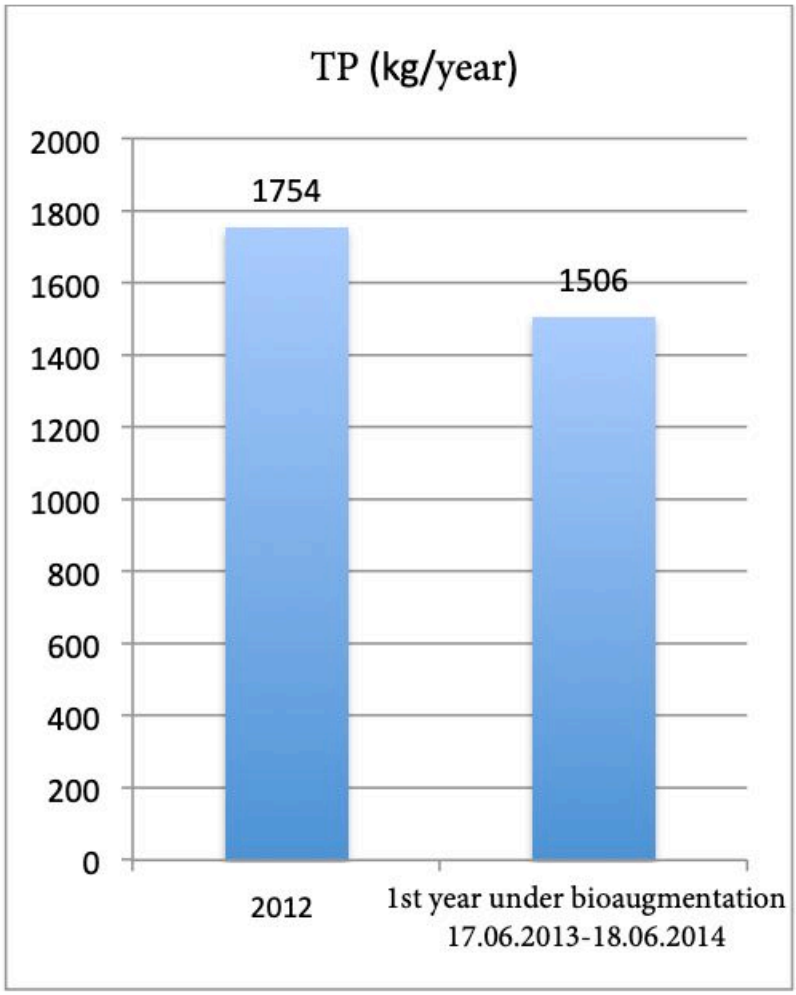


Decreasing environmental load:

Even a trouble-free, non-fined WWTP can further decrease the fees paid after COD, TN, TP load, as the below diagrams show:


COD (kg/year)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
17038
13738
2012
1st year under bioaugmentation
17.06.2013-18.06.2014


TN (kg/year)
3500
3000
2500
2000
1500
1000
500
0
2891
832
2012
1st year under bioaugmentation
17.06.2013-18.06.2014


TP (kg/year)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1754
1506
2012
1st year under bioaugmentation
17.06.2013-18.06.2014