

Case Study - Malatech Bioaugmentation

450 m³/d Municipal Wastewater Treatment Plant of a small city with outdated infrastructure

Goals of bioaugmentation:

Increasing the treatment capacity of the poorly equipped activated sludge reactors, eliminating fines, and effluent limit violations. The plant treats the municipal wastewater of a small city. The infrastructure is old but the operator cannot expect renovation in the near future though. The small city covers a very large area, which means that the Hydraulic Retention Time of the raw wastewater in the canalization system is high, and the influent to the biology is partly septic. As a result, the plant struggled with heavy filamentous blooms, and excessive EPS formation which resulted incontrollable foaming, and scum formation on the Dortmund-type clarifier throughout the entire year, not just at seasonal turns. Effluent violations have become continuous for COD, BOD, TSS, NH₄-N, TIN, TN. Operator aimed to reduce or preferably eliminate environmental fines by increasing the biology's treatment capacity by only bioaugmentation without CAPEX.



Author: Malatech Water Ltd.

Title: Municipal wastewater treatment plant optimization

Our client is a regional municipal operator of potable water, wastewater canalization, and wastewater treatment plants. This small WWTP is an outdated structure, built on ground level, covered by a lightweight building only. Temperature fluctuations of the biology between the seasons are higher than those WWTP's which are lowered in-ground. The building is in the worst condition, not the WWTP itself. The basic functions work, recirculation pumps, blowers, diffusers are in acceptable condition. The control system is ancient. The raw wastewater enters an equalization zone after fine-screen treatment, also the sludge recirculation arrives in EQ from secondary clarifier. From here the mixed liquor is pumped into the anoxic basin, and flows towards the aerobic basin by gravity. Internal recirculation heads from the end of aerobic zone to the start of the anoxic. The last phase is secondary clarification done by a Dortmund-type clarifier in a very poor condition.

The metal parts are corroded, and the raw wastewater comes in with high septicity. EPS formation, and filamentous count is high, foaming in the reactors, and scum formation on the secondary clarifier was continuous. MLSS has been continuously washed out from the secondary clarifier due to poor sludge settling conditions, and scum formation. The desired Dissolved Oxygen concentration (2.0 mg/l) could not be maintained at the end of the aerobic reactor during peak hours. The operator has started to receive fines by the authority for nearly all meaningful effluent parameters except Total Phosphorus, which is removed by Ferric Chloride dosage.

Since the renovation of the plant was not in schedule for the near future, the operator opted for Malatech Bioaugmentation as a last chance to improve treatment efficiency, and reduce fines.

First, we restored COD, BOD removal, and optimized sludge structure to prevent further washout by Bioclean TM, and BioGuarde I. **In 2 weeks after start, the blower was capable of maintaining the desired 2.0 mg/l DO concentration again, moreover we managed to save a bit on energy consumption as well.**

Filamentous count, and EPS formation dropped, so the clarifier's surface showed a better, and maintainable outlook, as it is shown below. Suspended solid washout diminished significantly.



before bioaugmentation



after bioaugmentation

The shock dosage of Bioclean TM was 4 kg/d on week 1, followed by 2 kg/d on week 2, then 1 kg/d on week 3, and also 1 kg/d on week 4. The maintenance dosage was 0.25 kg/d, dosed into the raw influent after pretreatment.

BioGuarde I was used at 1 l/d dosage for the first 2 weeks only.

From week 5, a simple maintenance dosage only with Bioclean TM at 0.25 kg/d has proven to be enough for maintaining good results summarized as follows. **We managed to eliminate fines for all parameters set up**

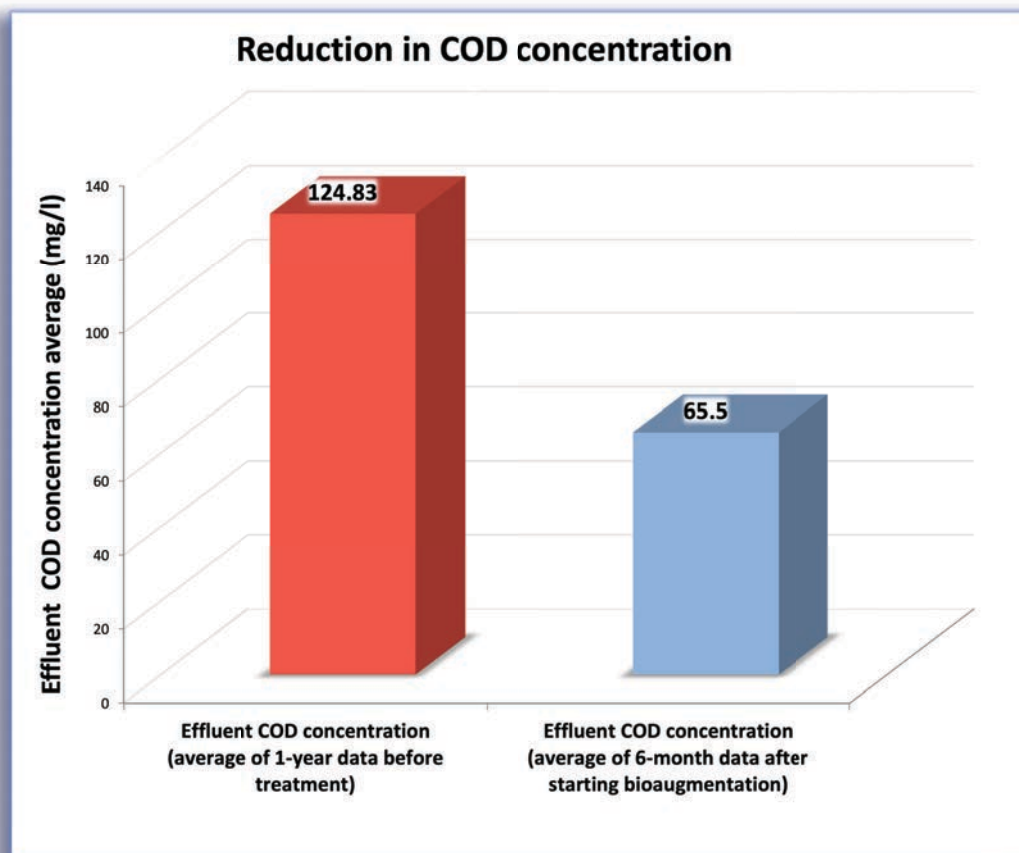
in the goals by the customer. The plant still runs bioaugmented with (unfortunately) the same infrastructure after 13 years, and the operator has not been fined for effluent violations.

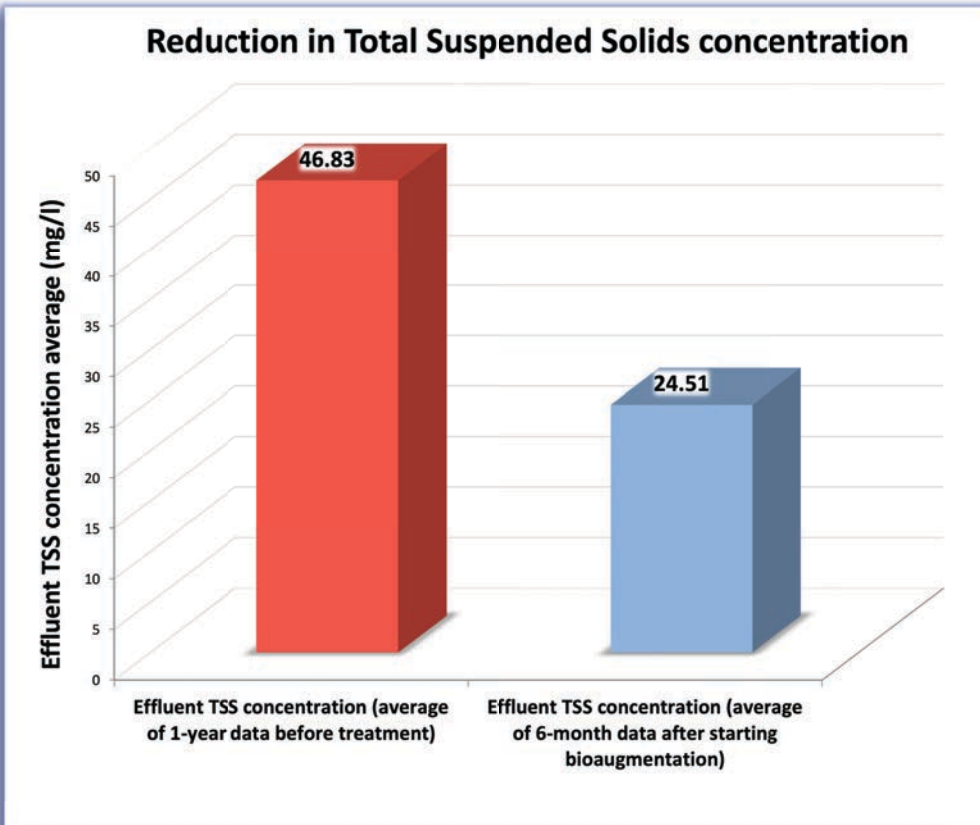
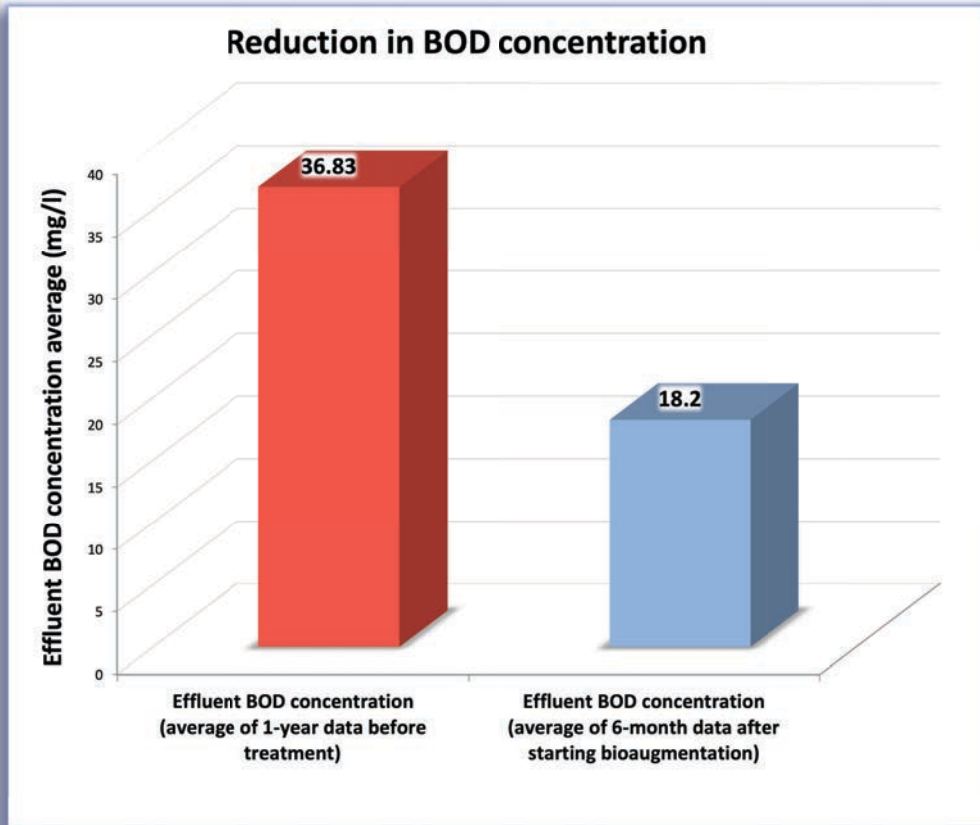
Results:

As it shown on the diagrams, effluent quality has been restored, and the plant can handle the increased load. **COD, and BOD removal became stable, as well as nitrification. The improved sludge structure and settleability eliminated sludge washouts from the secondary clarifiers which was caused by increased hydraulic load, and loose flocs before our treatment, which can be seen on the improvement of TSS values.**

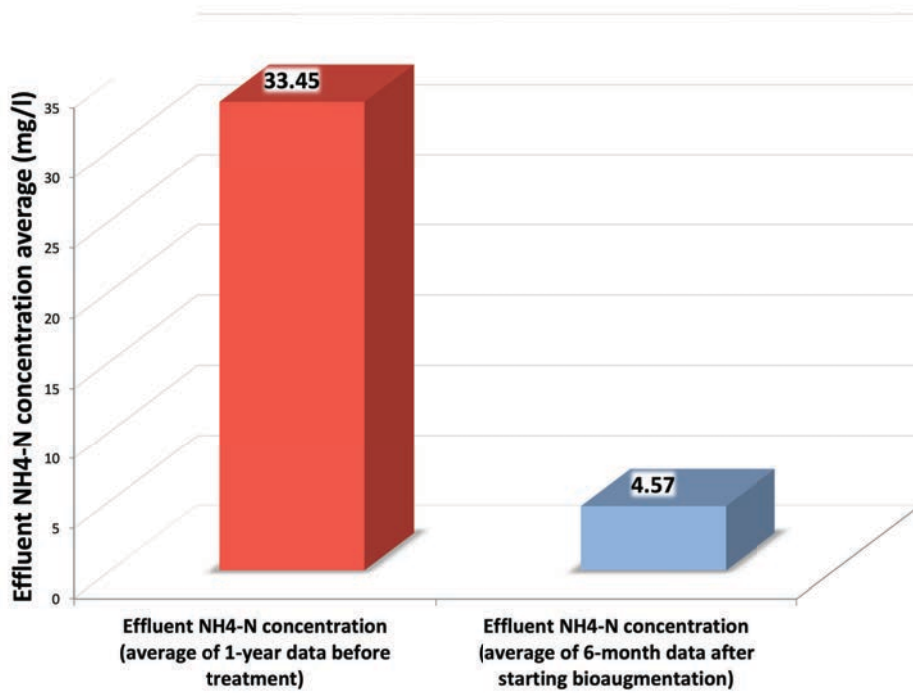
Total Nitrogen, and Total Inorganic Nitrogen removal: Bioclean TM has a massive impact on denitrification, it boosts Nitrogen removal both in anoxic, as well as in the aerobic reactors by its unique microbes with high simultaneous nitrification-denitrification (SND) capabilities. By enhancing the floc 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.

OPEX reduction: hardly believable, but by bioaugmentation we are able to save OPEX at such, seemingly hopeless plants as well. As it is shown on the diagrams, both **excess sludge production, and energy consumption has dropped,** but the **biggest cost saving was that the suction car did not need to come every week** to clean the surface of the secondary clarifier, and do multiple rounds with the removed up-flown scum layer.

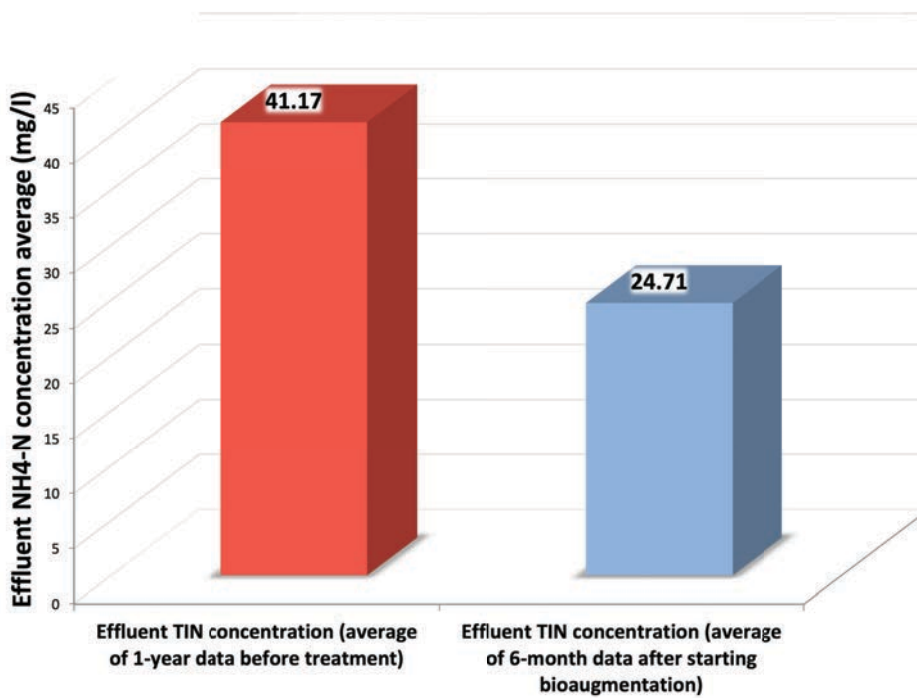


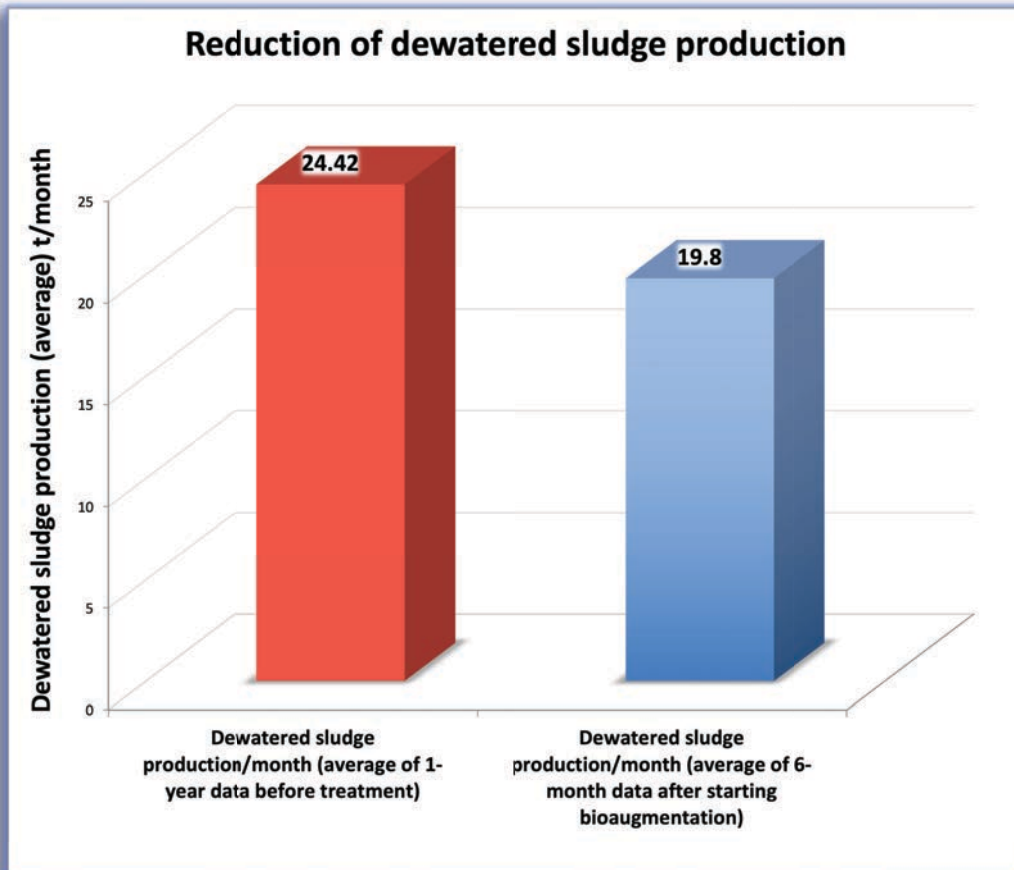
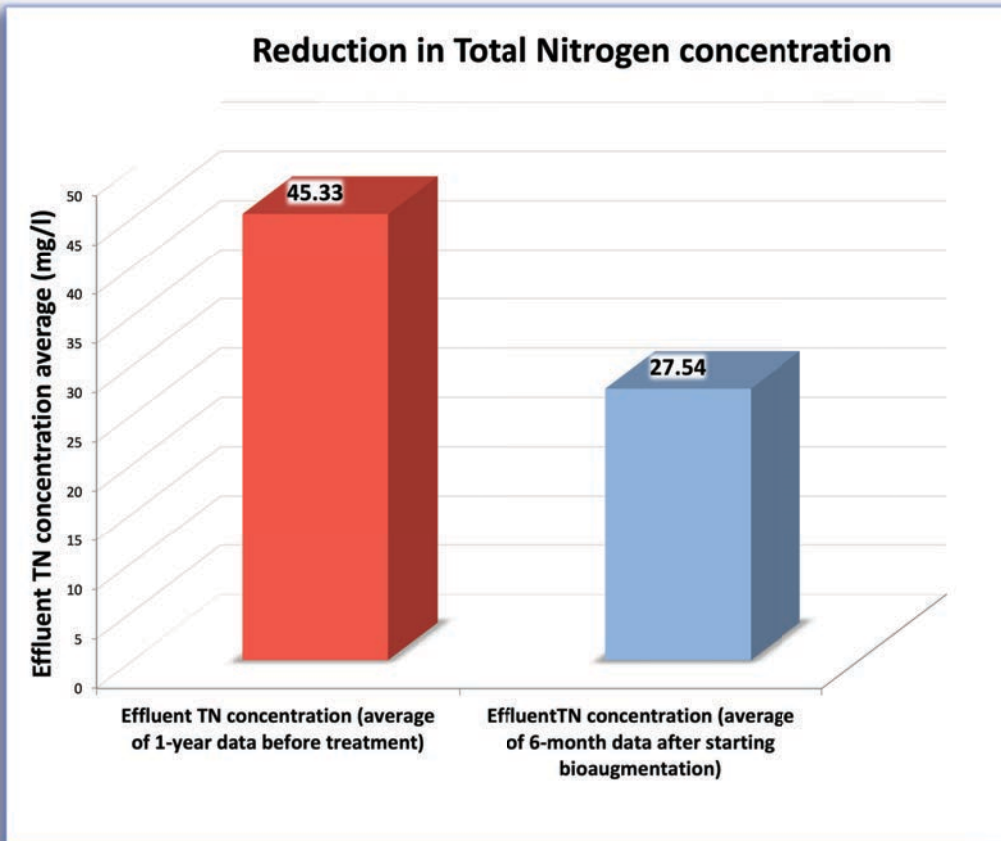


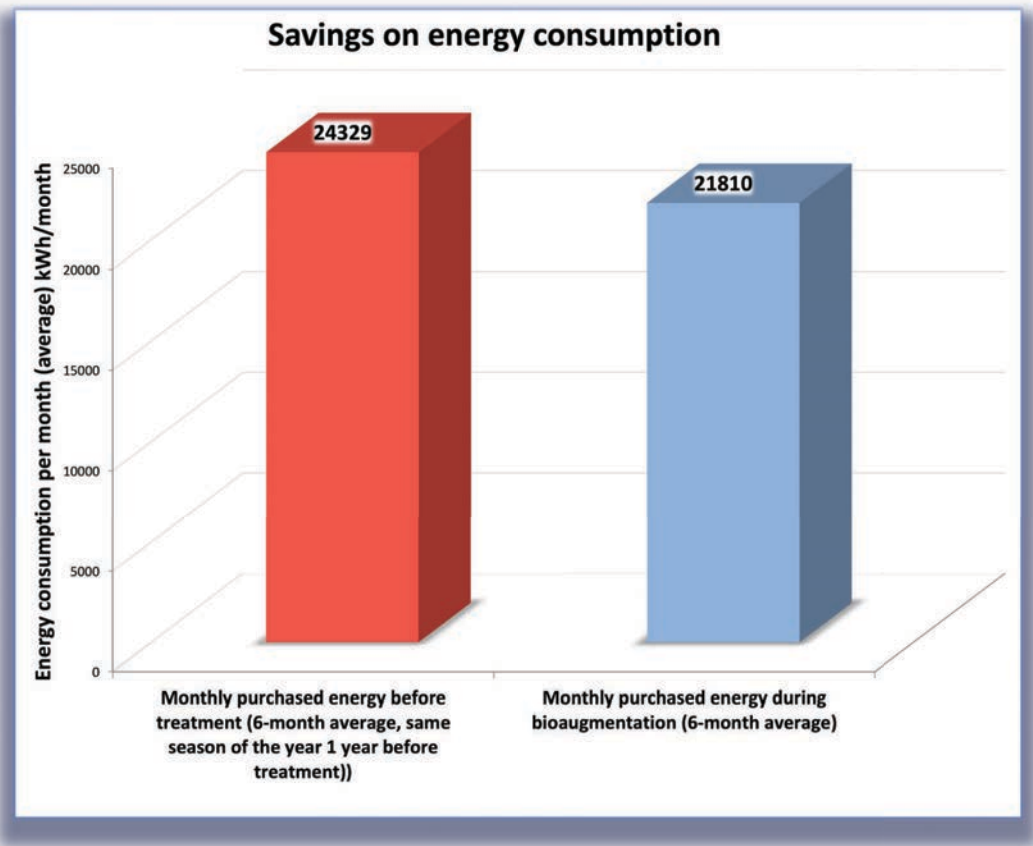
Reduction in NH4-N concentration



Reduction in Total Inorganic Nitrogen concentration







Effluent after bioaugmentation