

Case Study - Malatech Bioaugmentation

280 m³/d Seasonal Fish Processing SBR industrial WWTP with Tertiary Treatment Pond

Goals of bioaugmentation:

The industry releases its tertiary treated effluent into the sea. Due to fluctuating factory production, and raw material quality, the cumulative load varies in a high range which the activated sludge can hardly handle. Nitrification, and denitrification both had problems in the SBR reactors from time to time, and the tertiary treatment pond was unable to handle the Nitrogen load of the secondary treated effluent. When the effluent did not meet with authority requirements, and could not be released into the sea, the client was forced to transport the treated effluent by trucks to a nearby municipal WWTP. The client aimed to eliminate this huge cost, and targeted to meet with all authority limits continuously for the effluent.

Since the operation of manufacturing is seasonal, there is no production from mid-June till mid-September. The operator drained, dewatered, transported, and disposed the SBRs' content each year after season, and brought municipal activated sludge for inoculation at every start-up. The client was keen on avoiding this massive cost by keeping the activated sludge alive for more than 3 months in summertime.

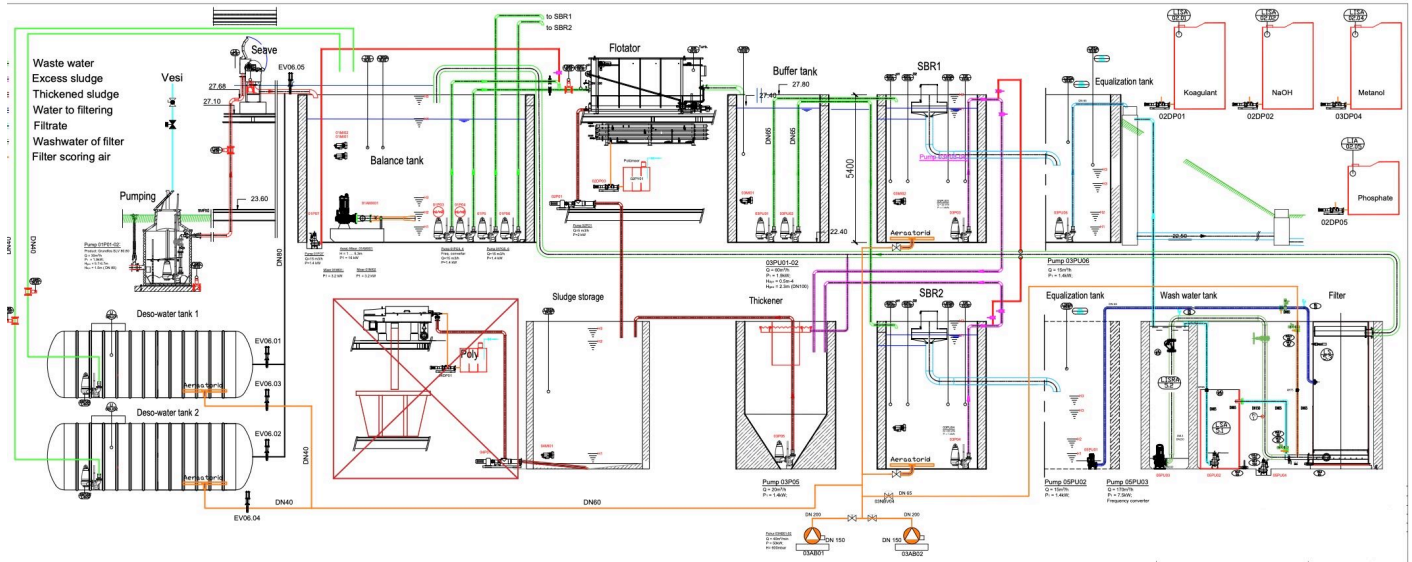


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Title: Food processing (fish) SBR wastewater treatment plant optimization

The client factory processes herrings to prepare oil & protein powder products for animal feed industry. The company is based in EU, and supplies mainly to EU market.

The plant is modern with an EQ tank receiving factory outlet, which is followed by a DAF unit, and a buffer tank. When Malatech Bioaugmentation started in February 2021, 2 SBR units were in operation. In the recent years the factory increased its production, which resulted in increase in cumulative load either, so an identical 3rd SBR unit has been built in 2024.



Our result summary below shows the data before the upgrade. Our treatment has been continuous since 2021, and effluent limit violations have been eliminated for late spring 2021, and the plant runs trouble-free since then, releasing the tertiary treated water into the sea again.

The secondary treated effluent of the SBRs flows into a tertiary treatment pond located on the seashore. The pond has no mixing or aeration. Natural algae growth provides Dissolved Oxygen, but thanks to high nutrient concentrations, algae blooms happen frequently which had adverse effects on the final effluent rather than positive in the past.

The DAF-treated influent to SBRs have a COD 3 000-4 000 mg/l, TN 350-600 mg/l. The main problem was the malfunction of nitrification, and denitrification in case of shock loads, that caused effluent violations in NH₄-N, and TN. **The bioaugmented treatment capacity, and the optimization of effluent NH₄-N, and Total Nitrogen parameters were the main reasons the client chose to proceed with Malatech Bioaugmentation.**

The manufacturing season ends in mid-June, and restarts in mid-September. Draining, dewatering, transporting, and disposing the activated sludge of the 3 SBRs after season, then importing municipal activated sludge in September for start-up have enormous costs. Besides the kick-start of manufacturing results a massive immediate cumulative load in COD, NH₄-N, and TN. The imported municipal activated sludge needed several weeks to adapt, and perform well. **The client looked for an alternative to avoid the workload, and costs of this misery, and shorter adaptation by keeping the activated sludge alive in the SBRs for low cost in the hot summer without load.**

We have used **Bioclean TM, and Ammonia Guard** for bioaugmenting the activated sludge in the SBRs. Bioclean TM generally improves the operational window of the activated sludge bacteria for various parameters, and increases its treatment capacity, and its resistance towards shock loads. Dosage was 5 kg/d on week 1, 3 kg/d on week 2, 2 kg/d on week 3, 1 kg/d on week 4, while we kept maintenance dosage at 0.5

kg/d onwards. After 5 weeks of bioaugmentation with Bioclean TM, we introduced Ammonia Guarde to restore nitrification (3 l/d) for 2 weeks. Whenever operator experiences a defect in nitrification since then (effluent NH4-N rises above 5 mg/l in any of the SBRs' effluent), Ammonia Guarde is applied at 0.5 l/d dosage for a few days for the problematic SBR for a quick restoration of nitrification.

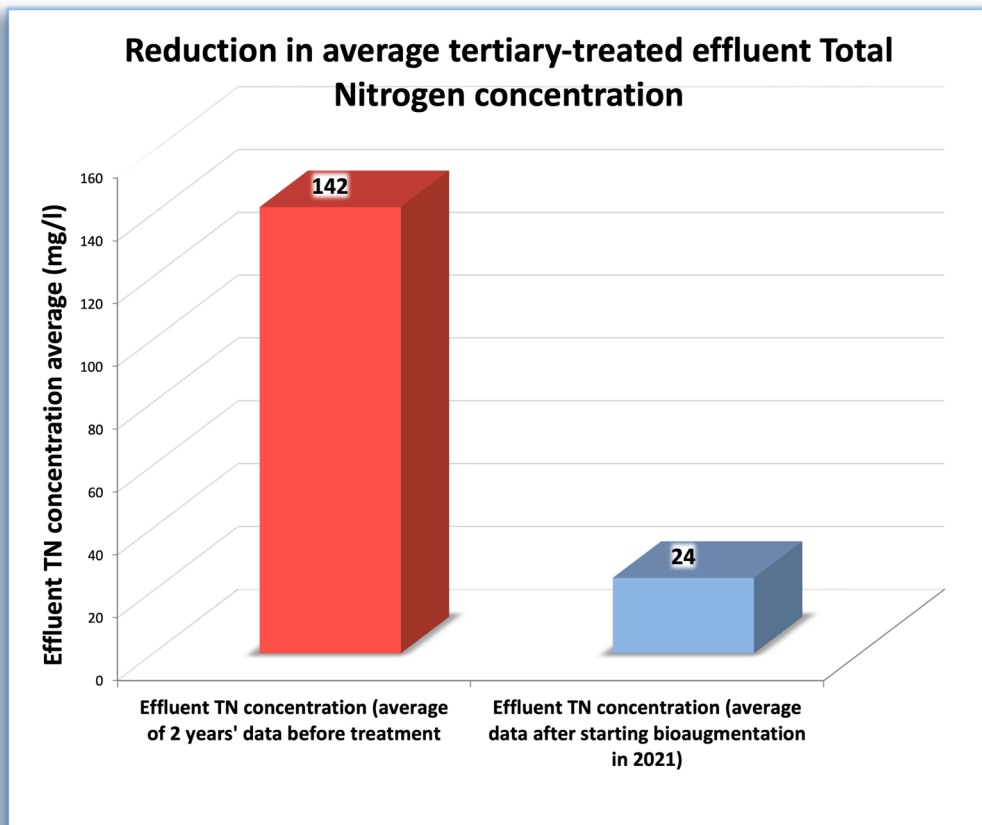
The tertiary treatment pond is bioremediated by Bioclean Pond Clarifier with 0.5 kg/d dosage to provide algae control, eliminate bottom sediment layer & minimize its formation to avoid the need for dredging, and bring final effluent parameters further down for tertiary treated effluent, especially for COD, BOD, TSS, NH4-N, TN, TP.

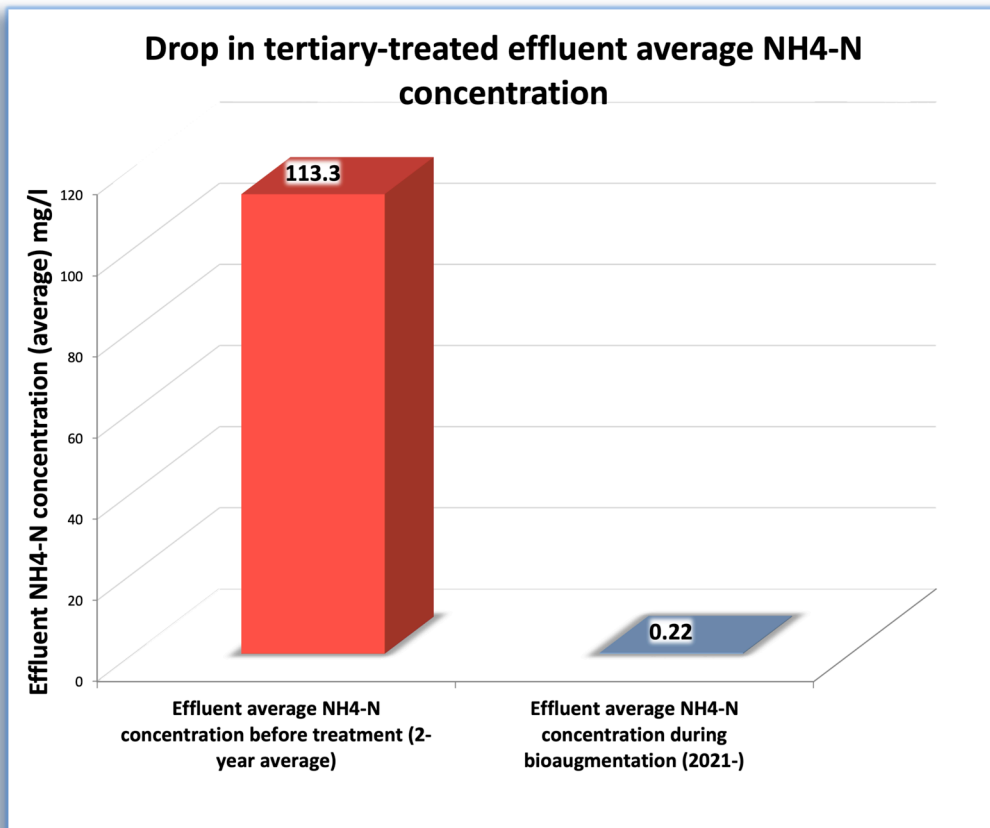
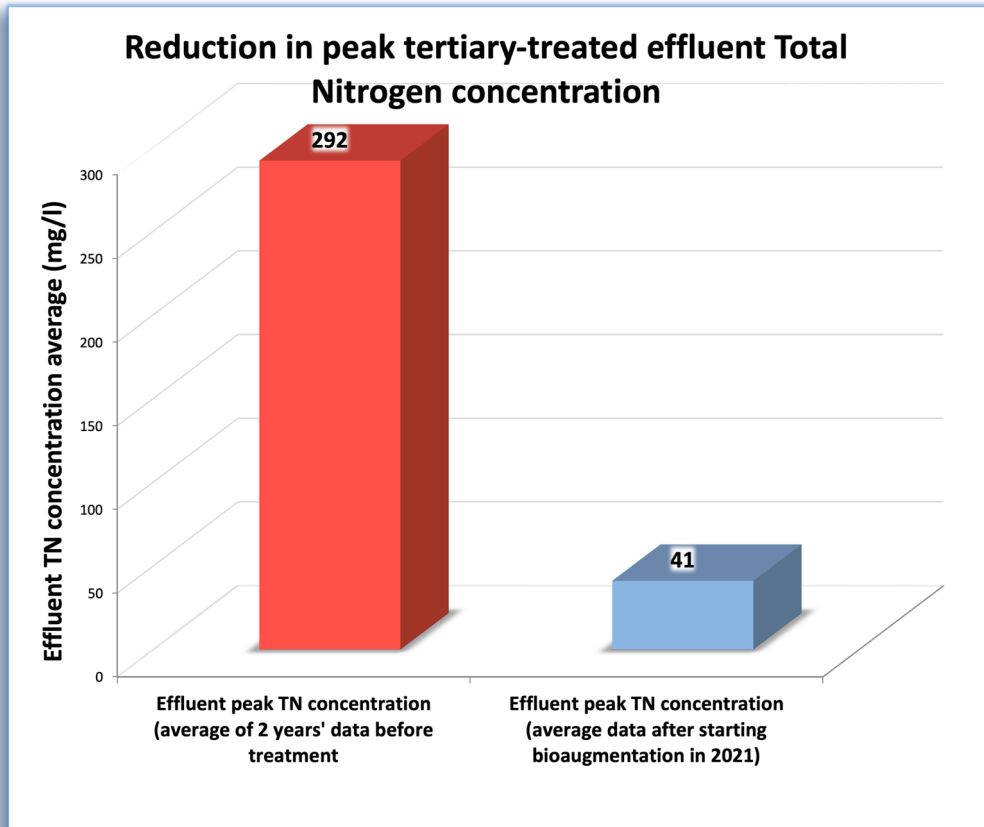
The activated sludge is kept alive throughout the 3-3.5-month summer break by applying temporary aeration periods, and Vickzyme treatment with 12 kg/week (4 kg/week/SBR).

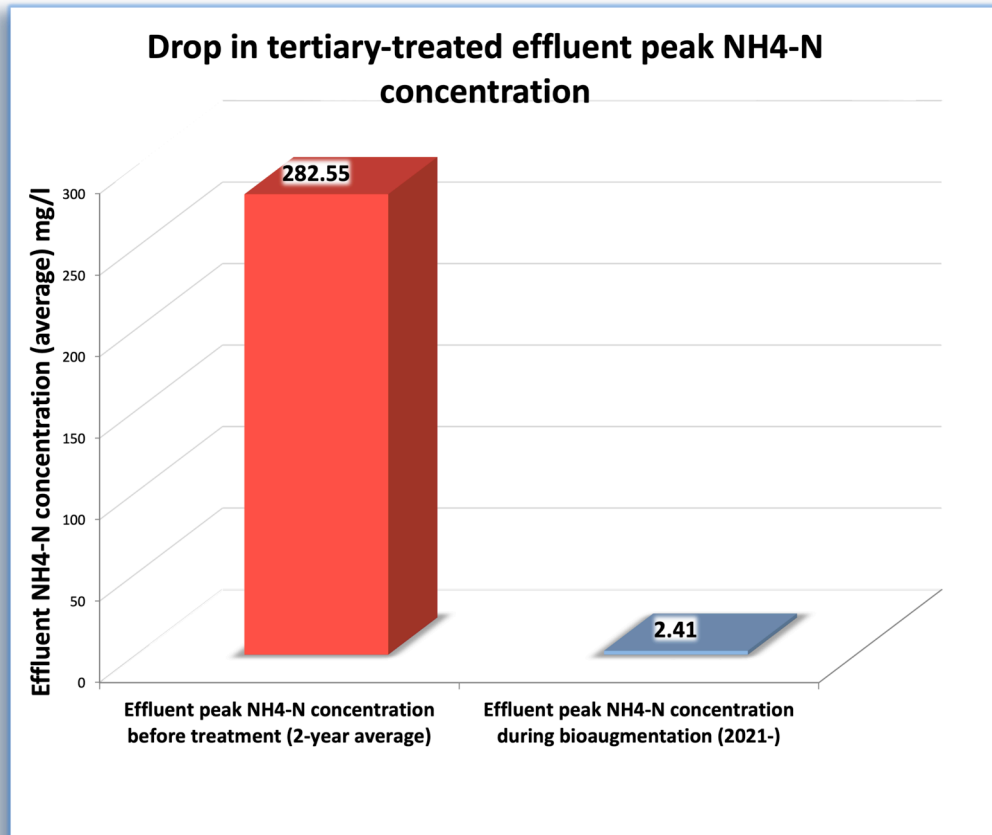
Results:

We have started bioaugmentation in February 2021 with partial nitrification, secondary treated effluent NH4-N above 200 mg/l for the SBRs, and TN above 250 mg/l. Nitrification has been stabilized for late March 2021, while denitrification stabilized for late April 2021, providing trouble-free operation since then. We have started to bioremediate the tertiary treatment pond, which started to serve as a safety installation for lowering effluent parameters further. Even if the factory released a shock load to the SBR reactors, and NH4-N rose above 5 mg/l, or TN above 50 mg/l, the tertiary treatment pond brought the parameters down by its upgraded pond biology with enhanced nutrient removal capabilities. The restoration of N-removal capacity of the SBRs after shock loads take 4-5 days with bioaugmentation, unlike before when it took 1-1.5 months.

Diagrams below show the average, and peak NH4-N, and Total Nitrogen concentrations for final effluent before, and during bioaugmentation.







Using Vickzyme's capabilities, the operator managed to spare a decent amount of costs by keeping the activated sludge alive in the 3-3.5 month-long off-season in the summer when there is no inlet raw wastewater to the WWTP. Operator has established periodic aeration times in the entire stagnant system, and dosed 12 kgs of Vickzyme once a week (4 kg/week/SBR).

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 September, the operator had an activated sludge with a very high active bacterial content, low inactive content.

In September (every year since 2021) the operator started up with the usual immediate high cumulative load, but 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.