

Case Study - Malatech Bioaugmentation

240 m³/d Category 3 Animal Protein Manufacturer's industrial activated sludge WWTP

Goals of bioaugmentation:

The industry releases its treated effluent to a freshwater stream with strict effluent quality requirements. Whenever there is a change in manufacturing processes within the industry, or a technical equipment, truck, and floor washing is done, the WWTP receives a shock load in COD, NH₄-N, and TN, which caused temporary effluent limit violations in the past. Due to the nature of the industry, the daily flowrate of the raw wastewater is low, but volumes of the biological reactors are high, because the wastewater is very concentrated in pollutants, so cumulative load is high. Such plants need several months to recover in case of a biological failure. The client aimed to eliminate payment of fines without interacting in the manufacturing processes, or lowering the load, as well as shorten the time of recovery when shock load hits the biology. Secondary clarifiers have a bad design with high depth, and the sedimentation of the activated sludge was generally bad resulting occasional sludge washouts. Operator also aimed to improve sludge sedimentation with bioaugmentation.



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Title: Animal protein manufacturing effluent industrial activated sludge wastewater treatment plant optimization

The client factory processes poultry, and swine carcasses to prepare category 3 protein products. The company is based in EU, and supplies to EU market.

The activated sludge part after DAF is a continuous flow plant equipped with 1 pre-anoxic basin, and 1 aerobic basin, followed by 2 parallel post-denitrification zones, and 2 parallel rectangular secondary clarifiers which operate in an SBR-mode (aeration-settling-decanting cycles). Internal recirculation flows from the end of aerobic basin into the anoxic basin. Sludge recirculation flows from the bottom of the 2 clarifiers to the anoxic basin. Overall cumulated activated sludge reactor + clarifier volume is 3 000 m³. Activated sludge concentration (MLSS) is kept at 8 000 - 9 000 mg/l.

The operator struggles a lot with bad sedimentation of the activated sludge which is normal with the current influent quality, and reactor layout, but the construction of the secondary clarifiers does not help at all. Simply this technology for secondary clarification is not suitable for a protein manufacturer's WWTP. The clarifiers are very deep (5 m water level-height), and the sludge blanket is very high during decanting because of poor sedimentation, and inadequate settling method. That led to loss of MLSS with the treated effluent very often.

The plant has been renovated to its current form 6 years ago, and designed to treat the wastewater for the strict requirements (COD 75 mg/l, BOD 25 mg/l, NH₄-N 2 mg/l, TN 40 mg/l, TP 5 mg/l, TSS 30 mg/l)

The DAF-pre-treated inlet COD concentration is between 9 000 - 22 000 mg/l respectively, while NH₄-N varies between 1 500-2 800 mg/l. Hydraulic flowrate varies between 180-280 m³/d. Wastewater comes from 2 different production streams:

- Technological wastewater is 120-200 m³/d, with a raw COD 12 000 - 28 000 mg/l, TN 800-3 000 mg/l
- Condensate is 60-80 m³/d with a raw COD 3 000 - 9 000 mg/l, TN 800-1 600 mg/l

Temperature of the bulk in the reactors is 22 Celsius in wintertime, and may peak at 42 Celsius summertime.

Operator's aim with Malatech Bioaugmentation was to shorten the recovery time for the biology which was 2.5-4 months after a defect caused by a shock or toxic load. Due to the huge biological volumes, and low but concentrated raw wastewater, the plant struggled with Nitrite (NO₂-) buildup for several weeks, after nitrification started, which operator also wanted to address.

Within the given boundaries, operator also wanted to improve the activated sludge settling rate, and provide a safer operation for the secondary clarifiers.

Bioaugmentation materials used:

For restoring the treatment capacity after failures of the biology we have used **Bioclean TM, BioGuarde I, and Ammonia Guarde** for bioaugmenting the activated sludge. 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 6 kg/d on week 1, also 6 kg/d on week 2, 5 kg/d on week 3, 3 kg/d on week 4, while we kept maintenance dosage at 1 kg/d onwards until the treatment capacity was recovered each time.

BioGuarde I for further biological treatment capacity increase was added from Day 1 together with Bioclean TM (2 l/d) for 4 weeks. Ammonia Guarde has been applied for nitrification boost from the start of week 3 with 3 l/d until the nitrification was fully restored.

When the plant's operation is correct **Bioclean ALPHA + BioBooster Micro** combination is applied at a maintenance dosage (0.5 kg/week for Bioclean ALPHA, and 4 kg/week for Biobooster Micro). **The combination is set to improve settleability of the activated sludge, and eliminate issues at secondary clarification.**

Results:

Diagram below shows COD, and NH₄-N concentrations right from the start of bioaugmentation treatment in case of a nitrification, and COD removal defect of the biology. **It took less than 1.5 months to bring all parameters below targeted limits without Nitrite buildup, instead of 2.5-4 months like before.**

Sedimentation problems in the clarifiers have been eliminated entirely by Bioclean ALPHA + BioBooster Micro treatment.

The operator has been using our technologies with success for 17 years.

Effluent COD, and NH4-N concentrations from the start of Malatech Bioaugmentation

