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

500 m3/d Category 3 Animal Protein Manufacturer's MBR industrial WWTP

Goals of bioaugmentation:

The industry releases its treated effluent to a municipal wastewater canalization system of a city. Due to fluctuating factory production, raw material quality, including blood plasm load, the cumulative load varies in a high range which the activated sludge can hardly handle. The WWTP can keep effluent COD below 1 000 mg/l, but NH4-N below 100 mg/l, and Total Nitrogen below 150 mg/l are challenging, and the plant is fined for violating the limits by the local municipal sewage system operator. The client aimed to eliminate payment of fines without interacting in the manufacturing processes, or lowering the load

Author: Malatech Water Ltd.

Title: Animal protein manufacturing effluent MBR industrial wastewater treatment plant optimization

The client factory processes poultry and mammal 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 a pre-anoxic basin, aerobic basins, and a UF membrane bioreactor. Internal recirculation flows from the UF membrane reactor into the anoxic basin. Sludge recirculation flows also from the UF membrane zone to the anoxic basin. Overall cumulated activated sludge reactors' volume is 4 000 m3. Activated sludge concentration (MLSS) is kept at 15 000 - 16 000 mg/l.

The plant has been recently renovated, and designed to treat the wastewater for the canalization limits only (COD lower than 1 000 mg/l, NH4-N lower than 100 mg/l, TN lower than 150 mg/l). Such designs barely work well in real life conditions because of microbial reasons.

The DAF-pre-treated inlet COD concentration is between 13 000 - 32 000 mg/l respectively, while NH4-N varies between 1 100-4000 mg/l. Hydraulic flowrate varies between 270-500 m3/d. Wastewater comes from 3 different production streams:

- Technological wastewater is 120-200 m3/d, with a raw COD 12 000 - 18 000 mg/l, TN 800-1 800 mg/l
- Condensate is 100-220 m3/d with a raw COD 3 000 - 9 000 mg/l, TN 800-1 600 mg/l
- Blood plasm residual is 50-80 m3/d with a raw COD 15 000 (winter) - 132 000 mg/l (summer), TN 1 600 (winter)-10 800 mg/l (summer)

Temperature of the bulk in the reactors is 24 Celsius in wintertime, and may peak at 45 Celsius summertime.

The plant's biology is forced to operate at conditions of continuous overload, which has an adverse effect on nitrification, and denitrification, as well as shock-load resistance of the biology. Due to the high variation of C,N cumulative load, the biology is unable to adapt, and effluent violations happen from time to time.

Operator's aim was to reduce, preferably eliminate the cost paid for fines, and stabilize nitrification, and denitrification since the factory has been fined mainly for NH4-N (discharge limit = 100 mg/l) , and TN (discharge limit = 150 mg/l) violations.

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 10 kg/d on week 1, 8 kg/d on week 2, 7 kg/d on week 3, 4 kg/d on week 4, while we kept maintenance dosage at 1 kg/d onwards.

BioGuarde I for further biological treatment capacity increase was added from Day 1 together with Bioclean TM (2 l/d) for 4 weeks. Maintenance dosage of BioGuarde I is 0.5 l/d.

Ammonia Guarde has been applied from week 5 with 3 l/d for 3 weeks. The maintenance dosage is 1 l/d.

All materials are added to the 1st activated sludge reactor, the anoxic basin.

Results:

Diagram below shows COD, NH4-N, and TN concentrations right from the start of bioaugmentation treatment. **It took 1.5 months to bring all parameters below targeted limits. The plant has not received any fines since then.**

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Effluent COD, NH4-N, and Total Nitrogen concentrations form the start of Malatech Bioaugmentation