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Case Study - Malatech Bioaugmentation

450 m3/d Plastic Recycling Industry Activated Sludge Wastewater Treatment Plant with UF post-treatment

Goals of bioaugmentation:

Operating costs were very high, especially chemical usage, and energy consumption, which operator wanted to reduce by bioaugmentation. Besides, the industry releases its treated effluent to a freshwater canal, and did not meet with effluent COD regulatory limit. The nature of the industrial processes were the main reasons of the underperformance. When washing the plastic waste from various sources, depending on the raw material, the factory released organic substances into the wastewater stream, which caused serious inhibition for the biology from time to time. COD breakdown was suffering from the toxic shocks. Operator aimed to increase the resistance, and tolerance of the biology towards inhibitory substances, and inoculate the effective biodegradation of these organic substances, and to meet with regulatory limits. Also, the client aimed to keep the sludge at its full treatment performance for the 1-1.5-month shutdown in the winter, which ran into troubles in the past.

Author: Malatech Water Ltd.

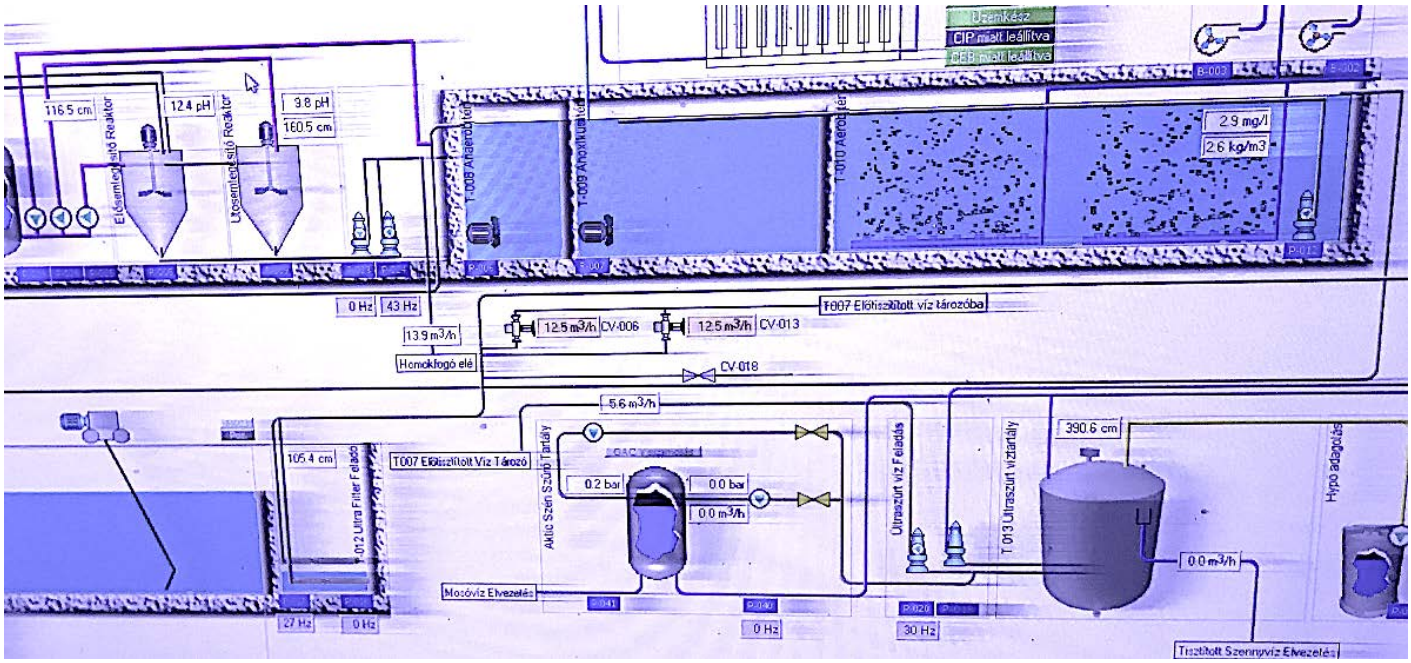
Title: Plastic recycling industrial activated sludge wastewater treatment plant optimization

The client is based in EU, operates in the CEE region, and supplies to CEE.

The plant is modern, well-equipped. After a physicochemical (Polyaluminium Chloride) pre-treatment the raw wastewater from plastic washing enters the primary clarifier with app. 1 000 m3/d flowrate. After primary clarification, etc. 550 m3/d primary treated water is recycled for reuse, 450 m3/d flows onto the biology. After biological treatment the secondary treated effluent flows into a UF membrane zone which removes TSS remainder. After the UF treatment, etc. 100-200 m3/d is released into nature, and the rest is recycled for reuse. The extreme amount of reuse results high salinity (TDS 2 500 -4 500) mg/l, which caused further inhibition to the metabolic rate of the activated sludge. Salinity is managed by the operator by final effluent released quantity, and introducing freshwater from a deep well into the system.

The biological reactors are covered, and located inside the production building. The reactor setup consists of an anaerobic Bio-P reactor, an anoxic reactor, and an aerobic reactor followed by a horizontal flow secondary clarifier, and a UF membrane zone. The internal recirculation pump has been removed from the system since the plant usually lacks Nitrogen, does not need upgraded Nitrogen removal in reality. Only the sludge recirculation from the secondary clarifier to the anaerobic zone is in operation.

The primary treated raw wastewater contains inhibitory, and toxic substances from plastic washing, even the COD content which is not toxic is mainly hardly biodegradable. Also, the raw influent is deficient in macronutrients (N,P). Operator doses Sodium Phosphate, Ammonium Nitrate, and Acetic acid to aid the biology.



Client chose Malatech Bioaugmentation with the following goals:

1. Meet with regulatory limit for COD in the final effluent
2. Reduce operating costs, focusing on chemical usage, and energy consumption
3. Keep the activated sludge alive at full performance during the 1-1.5 months winter shutdown when the factory stops at all, and no fresh influent comes in. During the start-up in January, it took 2-3 weeks for the biology to regain its treatment performance

Bioaugmentation products used:

Continuous treatment:

We have calculated with numerous inhibitory organic substances, which means the we have used **Bioclean TM, and SOS5300** for bioaugmenting the activated sludge. Bioclean TM generally improves the operational window of the activated sludge bacteria for varoius parameters, and increases its resistance towards inhibition. SOS5300 contains specific bacteria which are highly tolerant against the inhibition of Phenol, BTEX and other harsh chemicals, moreover they digest these substances. **BioGuarde I** also have been introduced for increasing the overall metabolic rate of the activated sludge.

The maintenance dosages are: Bioclean TM: 3 kg/week, BioGuarde I, and SOS5300: 1.25-1.25 litre/week

Treatment for winter break:

We kept the above product dosages for the winter break along with **BioBooster NOC,** increased Acetic acid dosage, and supplemental Na3PO4, and NH4NO3 dosage. The water in the system has been kept circulating. **The combination above resulted a healthy, and fully capable activated sludge for the kickstart in January, with no effluent fluctuations even from Day 1.**

Results:

Regarding operating cost, the table below shows **decent savings** for each item:

OPEX Savings	3-year monthly average before treatment	Monthly average during bioaugmentation 09.2021 - 04.2026
Polyelectrolyte usage	918.3 kg	**217.5 kg**
PAX usage	7 069.5 kg	**811.3 kg**
Na_3PO_4 usage	532.8 kg	**192.9 kg**
NH_4NO_3 usage	840.3 kg	**513.5 kg**
Acetic acid usage	4 715.4 kg	**2024.8 kg**
Energy consumption	41 004 kWh	**30 819 kWh**

Diagram below shows that the reduction of the effluent COD concentration from the initial 100-200 mg/l happened slower than usual due to the presence of inhibitory, and toxic substances. **By increasing the resistance of the activated sludge, COD started to drop, and peaks diminished.** After 6 months of treatment the effluent COD fell into a range between 50-80 mg/l. We still have peaks depending on the raw material the factory processes, and its toxicity. The peaks mean 75-80 mg/l effluent COD on some days.

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