

Optimising operations Pond treatment plant, Winkel, Germany Nitrification process started



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Operation

Pond 1 with 8000 m³:
1 OLOID Type 600 (for test) and
1 OLOID Type 400

Pond 2 with 4000 m³:
1 OLOID Type 400 and
1 turbine aerator

Period

Since 2013

Success

More stable discharge values
Saving of 20-30 % of energy
Nitrification process started

Description of the plant

The pond purification plant in Winkel is a waste water treatment plant for 5000 residents. The plant has 5 inlets from different sewer networks with different lengths (up to 5 km).

Process design: The water purification process is as follows: First sanding / raking, second pre-settling / settling tank, third aerated pond 1, fourth aerated pond 2 and last tertiary treatment pond.

Goal of the OLOID operation

Optimising operations: Start nitrification by proving enough oxygen while saving energy at the same time. In addition the amount of sludge has been reduced with zeolite.

Pond aeration

Initially 2 OLOID Type 400 were installed, one in each aerated pond. This installation already let to energy savings of 20-30 %.

In 2016, the position of the OLOID Type 400 in aerated pond one was changed to optimise interaction with the additionally installed OLOID Type 600. Pond 1 is now aerated and circulated with an OLOID Type 600 and OLOID Type 400 in combination with the already present jet aerator. In pond 2 the initial installation of one OLOID Type 400 was optimised by adding a turbine aerator. In pond 2, the OLOID and the turbine aerator replace 2 jet aerators with a power consumption of 6.5 kW each, while the OLOID and the turbine aerator together need 1.7 kW. The jet aerators were only operated for 6h/day where the OLOID and the turbine aerator are operated continuously. This holistic solution further lowers and stabilises the discharge values and a nitrification process has been started.

Results COD

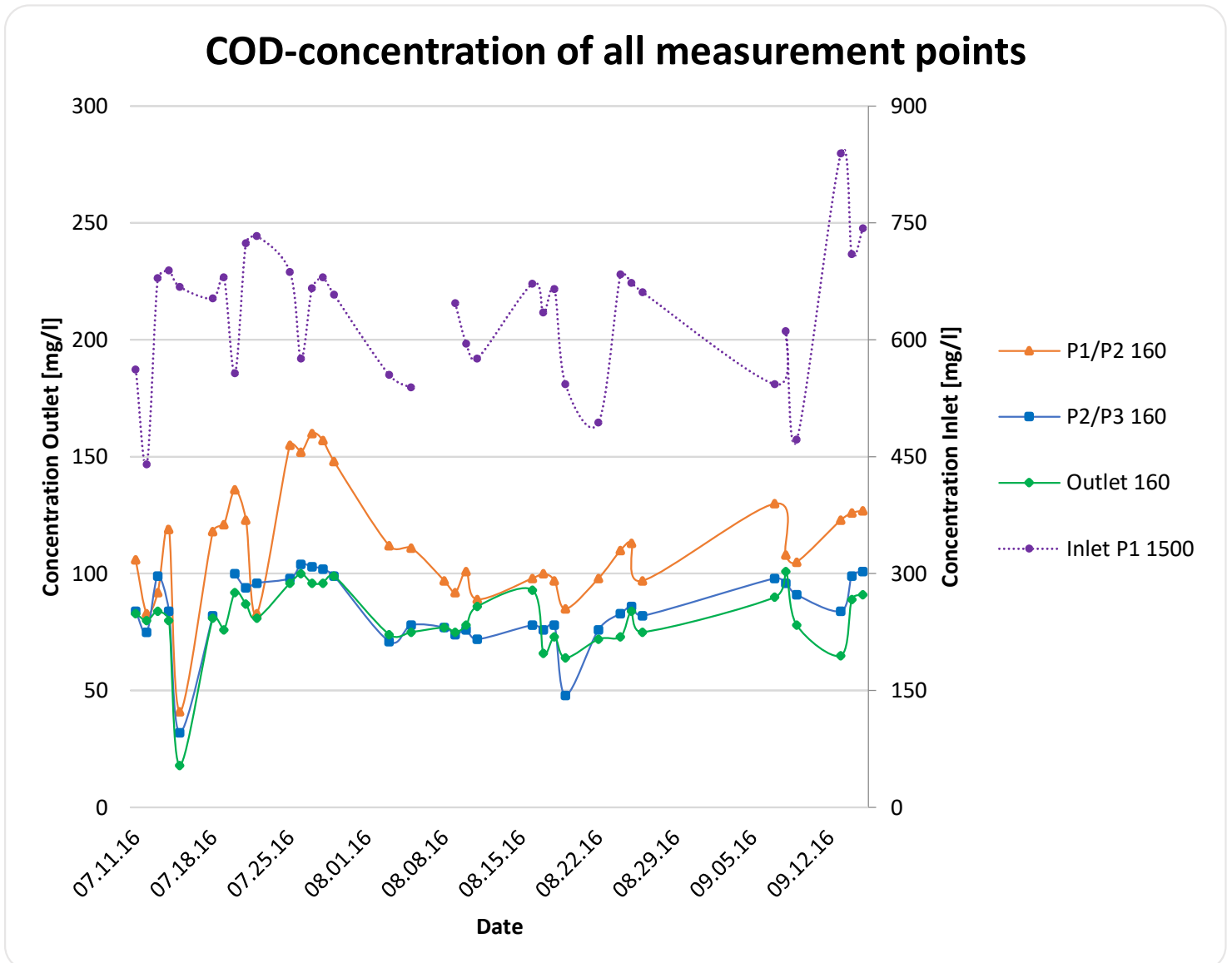
After an initial run-up time the ponds yield better discharge values with the same load.

Pond 1: Before in outlet of pond 1 was measured 100-180 mg/l (these also have been the values in the past), after the OLOID installation the discharge values are continuously 90-110 mg/l.

Pond 2: Before in outlet of pond 2 was measured 70-100 mg/l with one stray bullet after the OLOID installation the discharge values are continuously 70-80 mg/l.

The COD discharge values were reduced even under starting nitrification, which is described in the next point.

Note the Inlet values are displayed on the right hand scale.

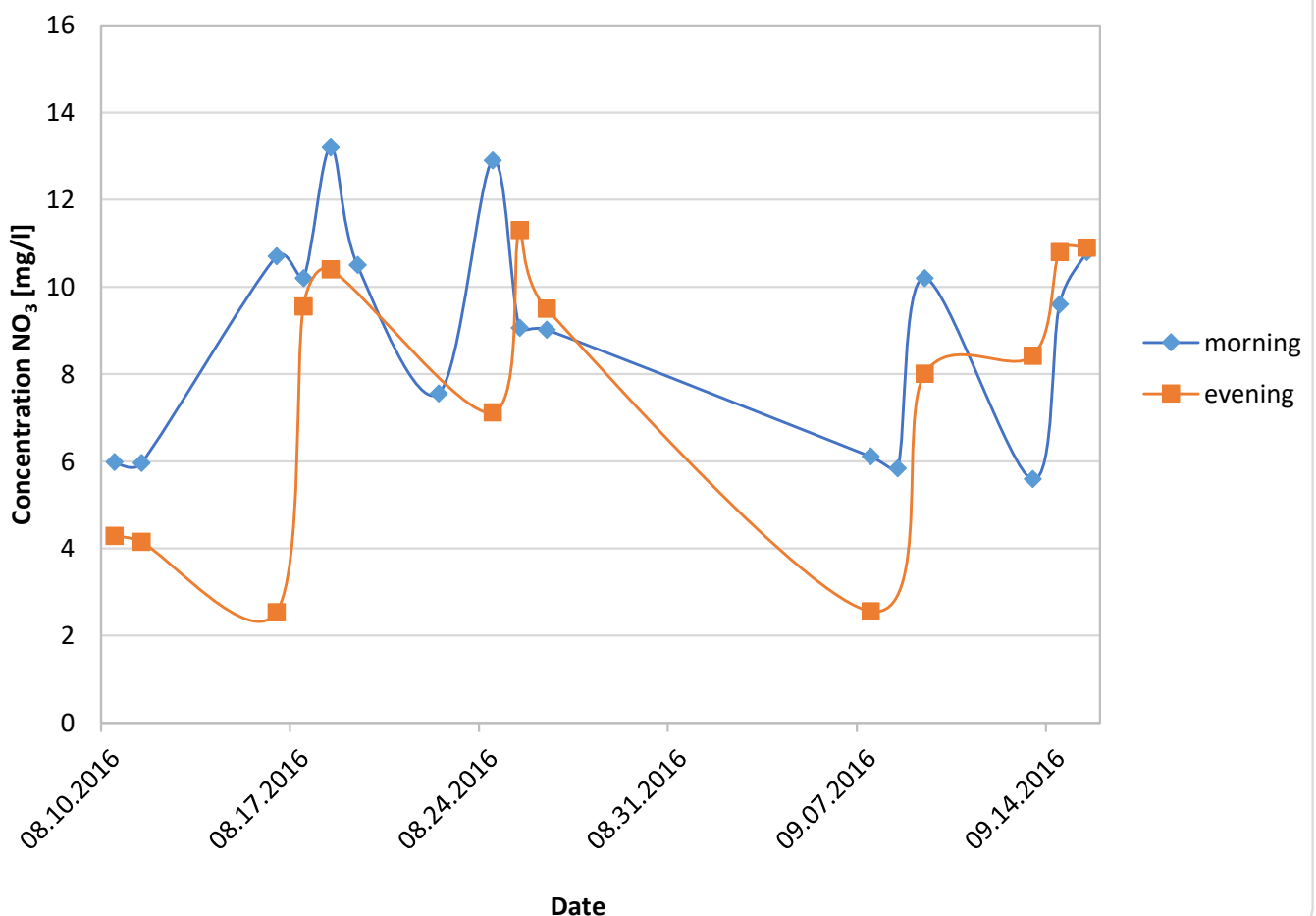


Results Nitrification

Nitrification was measured without returning sludge and only with improved circulation and better aeration (turbine instead of jet aerator).

- Nitrification could not be detected before (e.g. 0 mg/l Nitrate on 07/15/2016).
- After 3 weeks significant Nitrate values were measured in the overflow from pond 1 to 2 for the first time.
- After 4 weeks Nitrate values of around 5 mg/l can be measured in the outlet.
- After 5 weeks the Nitrate values on the overflow from pond 1 to 2 are around 1.5 mg/l and over 10mg/l in the outlet. This means that nitrification could be initiated through stronger circulation and better aeration and could be even built up despite rain events and difficult times of high temperature.
- In the nitrification process built up time oxygen values have sunken (clearly visible on 07/22/16) but stabilised after an initial built-up time. Organic material is liven up and nitrification also uses oxygen.

Drainage pond 2: Concentration NO₃

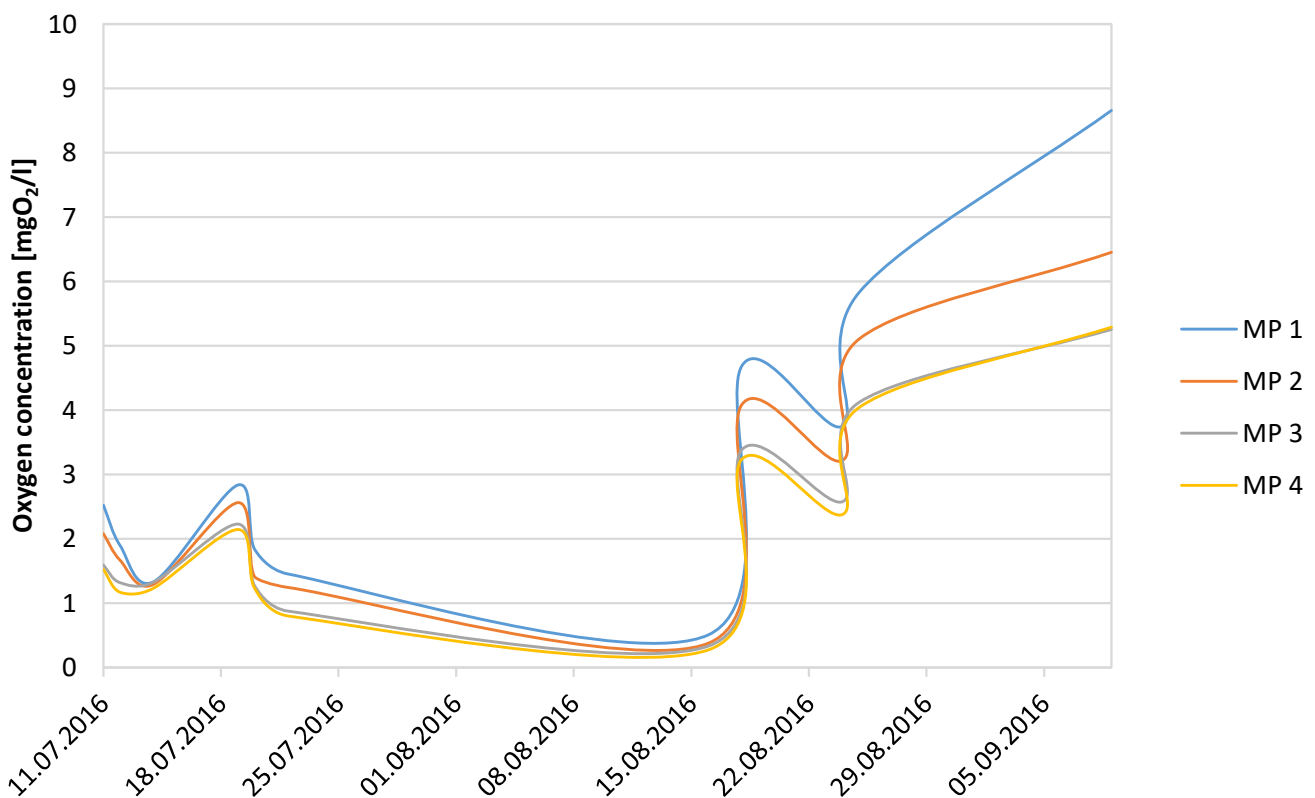


Results Aeration

For pond 2, where the turbine aerator is implemented

- Before 2 x 6.5 kW jet aerators alternatingly operated for 6h per day (total power consumption 39 kWh).
- Now, OLOID Type 400 and turbine aerator with 1.5 kW operated continuously (total consumption 40.8 kWh).
- With same total energy consumption the operation time was prolonged and at all 10 measurements points over 4 depth better oxygenation was detected.
- 2 days before the installation of the OLOID and turbine aerators the oxygen values were between 0.74 mgO₂/l and 2.12 mgO₂/l, with an average of 1.51 mgO₂/l.
- One week after the installation with same weather conditions the oxygen values were between 1.72 mgO₂/l and 3.5 mgO₂/l, with an average of 2.44 mgO₂/l.
- After 1 month after initial built up of nitrification the average oxygenation in pond 2 is 3.85 mgO₂/l.

Oxygen concentration in pond 2



Results Sludge reduction

In pond 2, the sludge level was measured before and after beginning to use zeolite.

- Before the use of zeolite the sludge level varies significantly between measurement points.
- After starting to use zeolite the sludge level is homogenised (differences smaller).
- The average sludge level is also reduced from 57 cm to 48 cm.

Measurement point	08/17/16 Before zeolite [cm]	10/05/16 After zeolite [cm]
1	40	40
2	80	30
3	70	60
4	100	60
5	50	50
6	20	50
7	60	50
8	80	40
9	20	40
10	50	60
Average	57	48

Results Summary

All of the above results indicate a better aeration as before with jet aerators. The aeration is 2-3 times better, which is difficult to assess because the nitrification process (which is oxygen demanding) has to be taken into account and is difficult to quantify and separate.

Good jet aerators have oxygen uptake values of up to 1 kgO₂/kWh where the turbine aerator can provide between 2-3 kgO₂/kWh. This can even be improved by the combination with the OLOID as the turbine aerator alone does not provide circulation. This means concentration on homogeneous oxygenation yields the efficiency for the operator.

The project was carried out jointly with our partners Mr. Tomberg, Prosys und Hydro₂

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