CHANGE IN DISSOLVED OXYGEN CONCENTRATIONS DURING AERATION AND MIXING USING A COMBINED SYSTEM

V Singrova and P Hlustik

INTRODUCTION

Wastewater aeration is one of the basic processes of biological aerobic treatment. At wastewater treatment plants, this is very important for the proper progress of treatment and it also entails the highest electricity demand at the WWTP. This process has a hydrodynamic and oxygenating effect.

In most wastewater treatment plants, blowers and diffuser are used to aerate the activation reactors. The combined mixing and aeration systems are generally used to a lesser extent, which results in less knowledge and operating experience. In addition, these systems are fundamentally different from conventional fine-bubble diffusers.

The research measurement the data of which is presented in this article, were made according to ČSN EN 12 255-15 Wastewater treatment plants – Part 15: Measurement of standard oxygenation capacity in the activation reactor. Some findings and information related to the measurement are also specified in the TNV 75 66 11 standard - Determination of the oxygenation capacity of aeration systems which has been valid since 1997 and has become obsolete.

The combined Triton 3HP system was used for the measurement- this system can mix the reactor content or even mix and aerate it at the same time. This article only contains an evaluation of the decrease and increase in oxygen in clean water.

MEASUREMENT

Reason for the measurement

- Operators discover certain advantages and differences compared to other aeration systems.
- It is necessary to apply an individual approach to the system design and its location in the reactor.
- The aim is to better characterize the system in order to make full use of its potential.

System description

- Combined systems are different from conventionally used fine-bubble aeration systems.
- A combined Triton 3HP system (figure 1) was used for aeration and mixing.
- The bubble flow is discharged downwards at a certain angle and only then the bubbles rise towards the surface.

Figure 1. Triton combined system**.**

Preparatory work

- It was necessary to find a suitable reactor. It had to be properly cleaned and painted (figure 2).
- Access to the tank from all sides was addressed.
- The tank was filled with drinking water because of water quality.
- It was necessary to devise mounting the probes and their fixed location at a certain point.
- Sodium sulphite and cobalt chloride were used for removing oxygen.
- The conductivity had to be checked after each measurement.

Figure 2. Tank with footbridges and the fixed probes.

Course of the measurement

- In each experiment, oxygen was artificially removed from the water.
- When the oxygen dropped to zero, aeration was switched on.
- It was completed several hours later when the dissolved oxygen saturation concentration was reached.

MEASUREMENT EVALUATION

- The following table 1 shows parameter values which were recorded during the measurement.
- In addition to these parameters, electricity demand, air flow and spot speed were measured.

Table 1. Values of other parameters for the first measurement.

1st measurement	Water temperature [°C]	Water conductivity [µS/cm]	Air humidity [%]	Air pressure [hPa]	Air temperature [°C]
Before measurement	20.5	1596	77	991	22.6
After measurement	20.8	1715	63	992	27.1

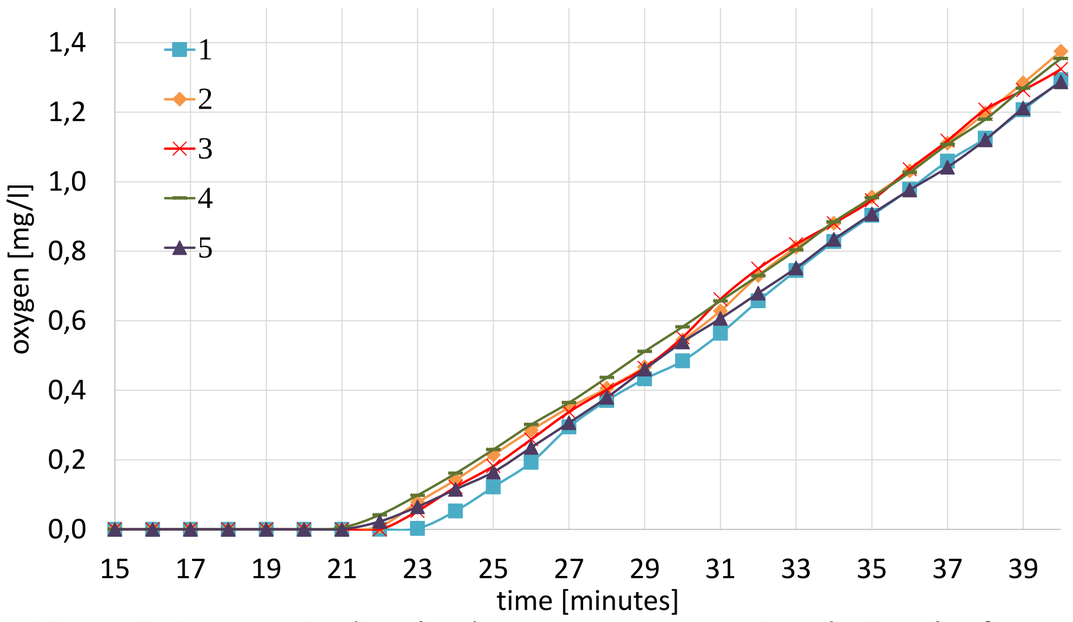

Figure 3. Increase in dissolved oxygen concentration during the first measurement for the five probes.

- The graph (figure 3) shows an increase in dissolved oxygen.
- For the sake of clarity, the graph is completed in the fortieth minute of aeration and contains records from all five probes.

CONCLUSIONS

- Over 2,100 values of dissolved oxygen concentrations are recorded from one measurement.
- The system can increase the concentration of dissolved oxygen above 9 mg/l.
- The value of 2 mg/ l was reached in both measurements approximately 30 minutes.
- The measurement results will be further processed in order to determine the oxygenation capacity.

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Institute of municipal water management, Brno University of Technology, Faculty of Civil Engineering, Žižkova 17, 602 00 Brno, Czech Republic
e-mail: singrova.v@fce.vutbr.cz, hlustik.p@fce.vutbr.cz