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Let's Solve Water

Case study

Aeration Control Improves Treatment Stability while Saving Energy

Results from Black River Falls, Wisconsin, USA

Dissolved oxygen (DO) concentration in the aerobic biological treatment step of a wastewater treatment plant is one of the most important parameters affecting organics and nutrient treatment performance. Low DO concentrations risks undertreatment and permit violation, while high DO concentrations results in wasting energy and higher energy costs. A reliable and automatic aeration control system can provide a stable DO concentration in aerobic basin, maintain a desired treatment performance and reduce aeration energy cost.

Implementation of the OSCAR™ process performance optimizer aeration control system at a conventional activated sludge plant in Black River Falls, Wisconsin, automatically maintained the desired DO concentration in the aerobic basin, maintained desired treatment performance, and provided a significant potential for reducing aeration energy costs.

Plant data

During the study, the DO concentration of the aerobic basin, the speed of the blowers and the energy usage were recorded continuously using the OSCAR system.

OSCAR aeration control system

During the reference period, the aerobic basin DO concentration was controlled manually by plant operators adjusting the blower speed on a daily basis. The OSCAR aeration control system was implemented and parameters were tuned from November 4th to November 13th. During the test period, the aerobic basin DO concentration was controlled using the OSCAR aeration control system. The DO setpoint was set to 2.0 mg/L to produce sludge with good settling characteristics, assure oxygen penetration to the interior of the activated sludge floc, and assure complete nitrification.

TEST PLANT: Black River Falls, Wisconsin, USA
DESIGN FLOW: 0.86 MGD
TEST DATES: October-December 2014

PROCESS CONTROL SYSTEM

Before upgrade	• Two blowers (25 HP and 60 HP) • Manual adjustment of blower speed on a daily basis (only 60 HP or combination of both)
After upgrade	• Same blowers with VFDs • Automatic control of the blower speed based on the DO concentration in the aerobic basin • Automatic operation (only 60 HP or 25 HP or combination of both)

TEST PERIODS

Reference period	• No automatic aeration control
OSCAR aeration control	• Automated aeration control • Controlled with OSCAR aeration control system to a constant DO setpoint of 2.0 mg/L

Aerobic Basin DO Concentration

Results illustrated in Figure 1 show that the aerobic basin DO concentration remained stable around the operator selectable setpoint of 2.0 mg/L during three weeks of operation. The OSCAR aeration control system automatically adjusted the blowers' speed, and the number of blowers operating (Figure 2).

During the reference period, the operators were running 60 HP blowers at contant speed for days or even weeks (Figure 2). During this period, the aerobic basin DO concentration was unstable and varied from 0.2 to 6 mg/L (Figure 1).

During the reference period, the blower was at times adjusted manually to a constant low speed. For example, the average aerobic basin DO concentration from October 19th to October 22nd was 1.5±1.2 mg/L, leading to a risk of under treatment and permit violations. At other times, the blower was instead operated at a constant full speed. Between October 23rd and October 29th, the average aerobic basin DO concentration was 3.4±1.5 mg/L, resulting in wasted energy and higher energy costs. The energy usage for this period was about 20% higher compared to operation during the test period.

Effluent BOD_5 and ammonia-N (NH4-N) analysis (Table 1) showed that the average treatment performance was comparable between both test periods.

Energy savings potential

Comparing the test period and reference period, the OSCAR aeration control system reduced the energy consumption on average 10% compared to manual blower control. The reduction was attained by ensuring that the basins constantly were operated at a DO concentration sufficuent for the treatment needs while preventing unnecessary overaeration.

Conclusions

This study showed that the OSCAR aeration control system is capable of automatically adjusting blower speed and operation to maintain a stable DO setpoint, maintain a desired treatment performance, and save aeration energy costs. The OSCAR aeration control system also provides greater operational stability.

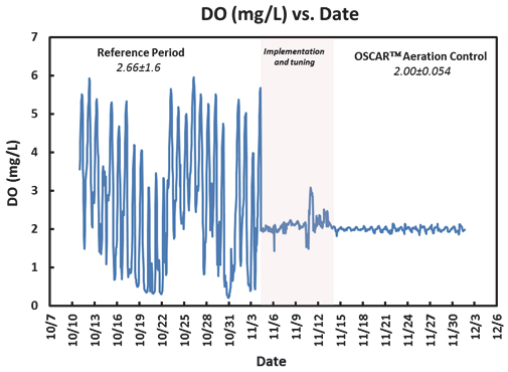

Figure 1: Aerobic basin DO concentration over time.

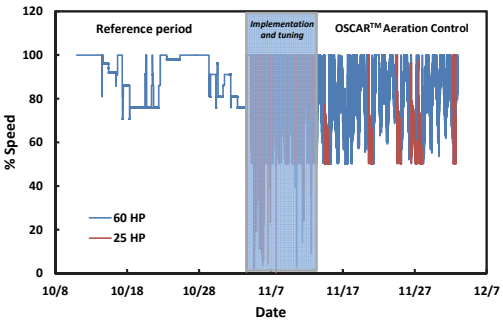

Figure 2: Aerobic basin DO concentration over time. 100% speed corresponds to 1500 scfm for 60 HP blower and 700 scfm for 25 HP blower.

Table 1: Treatment Performance

		Reference period	OSCAR aeration control
Infuent flow	MGD	0.56	0.54
Ave effluent NH4-N	mg/L	0.14	0.14
Ave effluent BOD	mg/L	6.5	8.6

"We love the way the OSCAR aeration control system is automatically controlling blower speed and operation, and maintaining stable DO concentration that we never achieved during manual operation. Currently, we do not need to worry about blower operation during work days, weekends or long weekends. Furthermore, we noticed significant aeration energy cost savings by maintaining stable DO concentration 24/7 without compromising treatment performance."

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