xylem
Let's Solve Water

Case study

Solids Inventory Management System (SIMS) Controls MLSS Concentrations to Meet Treatment Objectives

Results from Black River Falls, Wisconsin, USA

The mixed liquor suspended solids (MLSS) is universally used as a measure of biomass to control wastewater treatment processes. The control methods in place to adjust the amount of biomass in the system range from irregular manual adjustments to fully automated systems. A reliable and smart OSCAR™ process performance optimizer Solids Inventory Management System (SIMS) can automatically maintain optimal MLSS concentration based on an operator's preference to control the wastewater treatment plant (WWTP) operation and meet desired treatment objectives.

The MLSS concentration determines the effectiveness of an activated sludge process since a low MLSS may reduce treatment efficiency and a high MLSS may cause operational control problems. Therefore, continuous observation and monitoring of MLSS concentration is required to maintain optimal biomass in the system for desired treatment efficiency. When the operator finds the optimum MLSS concentration for a plant that produces the best effluent, he/she attempts to maintain this value by wasting the proper amount of solids. The traditional method available to the operator to maintain the desired MLSS concentration is to manually adjust the sludge wasting rate based on judgment or in some cases based on food to microorganism (F/M) ratio or solids retention time (SRT).

The OSCAR control system offers four control modes in total (MLSS mode, SRT mode, process optimized SRT or smart SRT mode, and Time mode) to optimize process operation while allowing operations staff full flexibility. Implementation of the OSCAR SIMS control system at a conventional activated sludge plant in Black River Falls, Wisconsin automatically maintained operator-desired MLSS concentration to meet treatment objectives and reduce operator oversight/adjustment of the process.

Plant data

During the study, the aerobic basin MLSS concentration, waste activated sludge (WAS) concentration, and WAS flow rate (Q)

TEST PLANT: Black River Falls, Wisconsin, USA
DESIGN FLOW: 0.86 MGD
TEST DATES: June 01-July 03, 2015

PROCESS CONTROL SYSTEM

Before upgrade	• Manual wasting to control MLSS concentration (approximate volume/day)
After upgrade	• Smart SIMS controlled wasting to maintain operator-desired MLSS concentration

TEST PERIODS

OSCAR control	• MLSS control: smart SIMS controlled wasting to maintain operator-desired MLSS

EFFLUENT PERMITS

BOD_5	• 30 mg/l
TSS	• 30 mg/l
TP	• 1.0 mg/l

were recorded continuously using the OSCAR SIMS control system (Figure 1). Laboratory analsyis of MLSS and WAS concentration was also carried out five days per week to verify sensor readings.

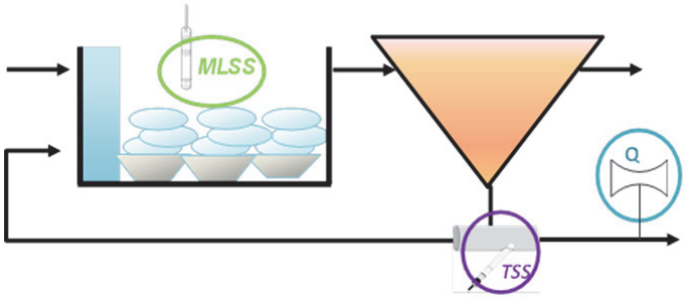

Figure 1: Location of sensors and flow meters.

OSCAR SIMS control system

Historically, the MLSS concentration was controlled manually by plant operators wasting an approximate volume of WAS per day. The OSCAR SIMS control system was implemented on June 1st, 2015 in order to provide stable operation and meet treatment objectives. From June 1st to July 3rd, the operator-desired MLSS concentration was maintained.

Operator-desired MLSS control

Figure 2 shows basin MLSS concentration when wasting was controled manually based on approximate volume per day. The plant operator wanted to maintain MLSS concentration close to 2000 mg/l but varied from 1900 to 2600 mg/l. Furthermore, there was no MLSS control during weekends or holidays. Results illustrated in Figure 3 show that the OSCAR SIMS control system maintained operator-desired MLSS concentration of 2100 mg/l. This smart control system automatically adjusted WAS mass wasting rate to keep a stable operator-desired MLSS concentration to meet treatment objectives. The average MLSS concentration during this test period was 2041± 40 mg/l.

Conclusions

This study showed that the OSCAR SIMS control system expertly adjusts WAS mass wasting rate to maintain operator desired MLSS concentration, providing stable operation and maintaining desired treatment performance. Routine operator decisions are less critical but effective routine maintenance is needed for successful smart process control system operation.

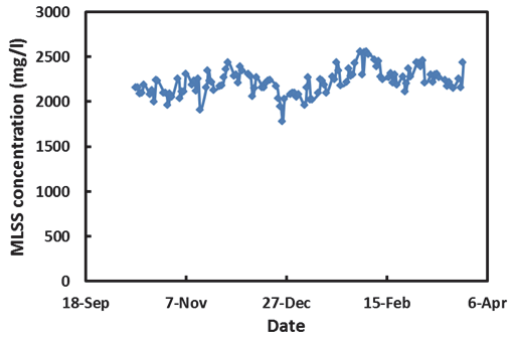

Figure 2: Basin MLSS concentration over time before SIMS control system implementation.

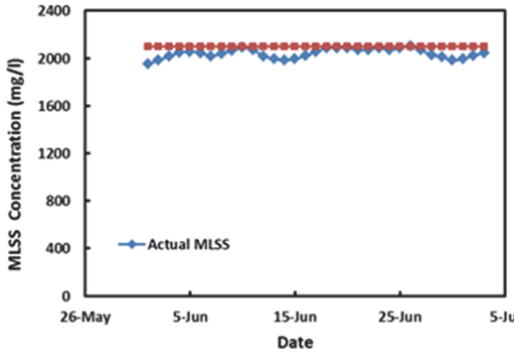

Figure 3: Operator-desired MLSS concentration over time after SIMS control system implementation.

Effluent BOD5, TSS and total phosphorous (TP) analysis during SIMS control implementation showed average concentration of 5.5 mg/l, 5.8 mg/l and 0.53 mg/l, respectively.

"Historically, we ran our waste activated sludge pump manually for a certain period of time per day. We love the way the OSCAR™ SIMS control system is automatically controlling wasting based on our need, maintaining stable operation and providing superior effluent quality. Furthermore, we do not need to worry about WAS pump run time during work days, weekends or long weekends."

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