

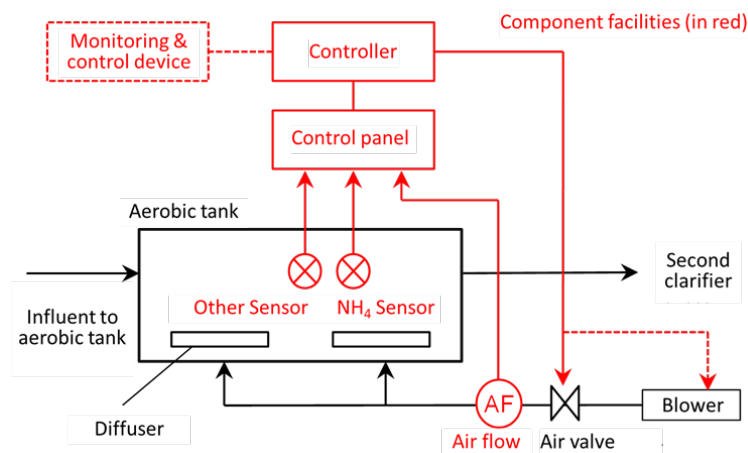
Systematization and Practical Application of Automatic Aeration Control Using NH₄ Sensor

(Research of FY 2017–2021)

1. Purpose

This study deals with a new automatic aeration control technology using a water quality sensor such as an ammonia nitrogen concentration meter (NH₄ sensor.) (figure 1: NH₄ control technology)

The study evaluates the new technology after systematizing outcomes from joint research to achieve the technology establishment.



*The number and set up location of measuring devices, including NH₄ meters, vary depending on the specific technology.

Figure 1. Image of NH₄ control technology

2. Outcomes of This Year

(1) Numerical analysis of different control technologies:

Researchers conducted numerical simulations for multiple ammonia control and aeration control, including the conventional constant DO control using the activated sludge model (ASM2d), to know the behavior of the aeration control under various conditions with inflow load fluctuations, different ASRT, etc. Outcomes are as follows:

- NH_4 -based aeration control could reproduce a 10% or more reduction rate of aeration airflow against the constant DO control, equivalent to the demonstration results.
- The followability of oxygen supply became visualized against the time change of oxygen demand inside aerobic tanks. It was cleared that suppressing aeration of the period having a small oxygen demand brought the reduction benefits of NH_4 -based aeration control.
- It was quantitatively confirmed that the more margin there was for nitrification, including a long ASRT and a small fluctuation of inflow load, the greater the effect of ammonia control on reducing aeration airflow (Figure 2.)

(2) Estimation of blower power reduction associated with the reduction of aeration rate: The researchers estimated the power reduction rate for multiple blowers with different configurations using time fluctuation data of aeration volume obtained from the above numeric simulation. The result made clear that controlling the number of blowers was more energy-saving than operating multiple blowers equally.

(3) Technology evaluation: JS Technology Evaluation Committee evaluated NH_4 -based aeration control for its technological features, introduction procedures, and operations management procedures. The committee published "Report on the Evaluation of Aeration Control Using NH_4 Sensor"

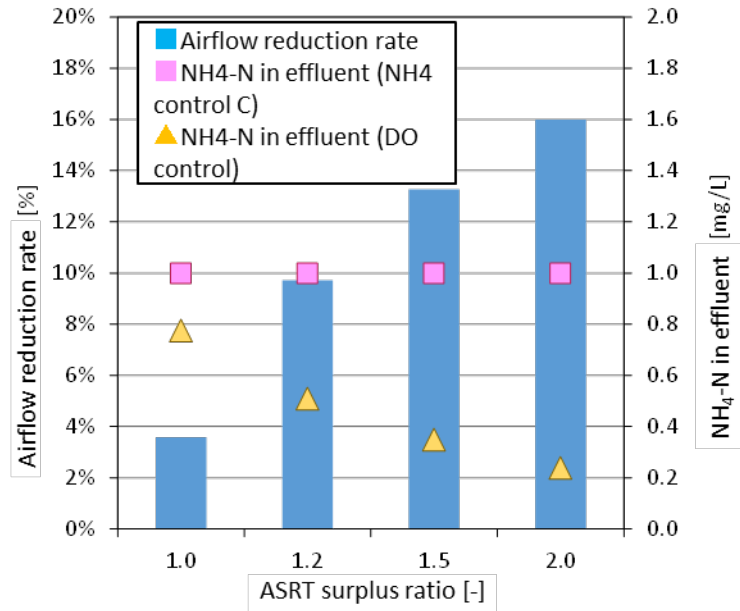


Figure 2. Example of numerical simulation results of aeration reduction rate (vs. constant DO control) according to ASRT margin ratio and NH₄-N concentration in effluent for NH₄ control

3. Future Schedule

The study will continue to promote generalization of ammonia control as control technology, including procedures for performance evaluation, introduction studies, and design.

Keywords: **NH₄ sensor, NH₄ control, Aeration control**