Research Collaboration on the Conventional Activated Sludge Process and Other Energy-saving Technologies

Year of Research	2013	Establishment of energy and resource recycling

(Purpose)

nsumption for fiscal 2010. Also, the electricity consumption of water treatment facilities accounts for approximately a half of this total consumption. Since the Great East Japan Earthquake, higher electricity prices have put pressure on the management of sewage works. Therefore, it is essential to save energy and electricity. Water treatment facilities consume a particularly large amount of electricity. For this reason, it is important to implement and spread energy-saving technologies.

In this research, we quantitatively assessed the effectiveness of energy-saving technologies for water treatment facilities in a sewage treatment plant, and also organized the characteristics and considerations, and summarized the obtained results into a technical report.

(Results)

(1) Study method

While focusing on the latest energy-saving equipment and the operation and control method that our research collaborator suggested, we qualitatively assessed the reduction in electricity consumption by checking the operation status of an actual facility and conducting case studies.

(2) Target technologies

The target technologies for this research are listed in **Table 1**. These technologies are classified into ① energy-saving equipment, ② operation and control approaches, and ③ technology to promote solid-liquid separation. We summarized the effectiveness of each technology and a combination of energy-saving equipment and an operation and control approach.

Table 1.:List of the target technologies

Energy saving equipment	① Low-power jet-pump-type sand blower
	② Membrane type air diffuser
	③ Magnetic bearing single-stage turbo blower
	④ Energy efficient agitator
	⑤ Circulation pump for water treatment
Operation and control approach	⑥ Air flow control system using an ammonia sensor
	⑦ Energy efficient operation achieved by reducing the rotation number of the agitator in the reactor
	⑧ Energy efficient operation method using the activated sludge model
Technology to promote solid-liquid separation	⑨ Filter system that recovers raw sludge from the influent sewage water
Combined technologies	Equipment: ② Membrane type air diffuser + ③ Magnetic bearing single-stage turbo blower Control: ⑥ Air flow control system using an ammonia sensor

(3) Results

We designed a model for a sewage treatment plant with a conventional activated sludge process and calculated the electricity consumption for the water treatment facility and sludge treatment facility. The result shows that the electricity consumption of the air blower accounts for approximately 60% of the total, which is the highest among the equipment. This result suggests that it is especially important to reduce the electricity consumption of air blower in order to reduce electricity consumption in a sewage treatment plant.

As an example of technologies to reduce the electricity consumption of the air blower, the results of the effectiveness of a combination of energy-saving equipment and an operation and control approach are shown in Table 2. The calculations showed that the electricity consumptions of air blowers were reduced by 59 to 69% after introducing the energy-saving technology. Since the inflow rate and water quality can vary by season and time, it is important to know the most effective combination of equipment and operation and control in order to maximize the performance of the equipment.

Table 2.:Results of preliminary calculations for the effectiveness of the energy saving technology (an example)

Item \ Case	Unit	Conventional type ①	Conventional type ②	Energy saving type
Treatment capacity (daily max. capacity)	(m^3/day)	40,000	40,000	40,000
Air diffuser	–	Air diffuser plate	Air diffuser plate	Membrane type
Air blower	–	Multi-stage turbo	Multi-stage turbo	Magnetic bearing type
Air flow rate control	–	Constant air flow rate	Constant DO	Ammonia control
Required air flow rate	(Nm^3/day)	356,000	231,000	105,000
Air flow reduction rate	(%)	71	55	–
Power consumption	(kWh/day)	7,808	5,886	2,417
Power reduction rate	(%)	69	59	–

(Summary)

We hope this research can contribute to further improvements in energy savings through the use of this technical report in evaluating approaches to reducing electricity consumption in sewage treatment plants.

※ Ishigaki Co., Ltd.; Kawasaki Heavy Industries, Ltd.; Kubota Environmental Service Co. Ltd.; Sanki Engineering Co., Ltd.; Tokyo Engineering Consultants Co., Ltd.;Nippon Jogesuido Sekkei Co., Ltd.; Maezawa Industries, Inc.; Metawater Co., Ltd.; Yaskawa Electric Corporation; Japan Institute of Wastewater Engineering and Technology

Inquiries ; Resource Recycling Research Department, Japan Institute of Wastewater Engineering Technology
Takashi Ishida, Shuichi Ochi, Takayuki Ohno, [03-5228-6541]

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