Promotion of Water Treatment Technology Considering Energy Optimization and Risk Control

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1. Introduction

Sewerage greatly contributes to maintenance of good water environment, and for that purpose, removal of harmful microorganisms in sewage is important as well as removal of organic matter and nutrient salt. Moreover, effort to reduce energy consumption related to water treatment is important for achieving sustainable environment. This Division is conducting research and study from various viewpoints for conservation of good water environment by sewerage.

2. Study on energy optimization in drainage basin

Because the energy efficiency of nitrogen removal in small-scale wastewater treatment plants is low, we studied whether energy consumption could be reduced in the whole drainage basin by integrating the pollution load removal and associated energy consumption of multiple wastewater treatment plants into large-scale wastewater treatment plants.

We made a simple design of treatment facility and estimated based on capacity calculation the amount of nitrogen to be removed and the necessary capacity of water treatment facility, and defined the water treatment facility according to the estimated capacity. Then, we estimated energy consumption by adding up electricity usage using the rated power of this facility. Based on the results of this estimation, we created a relational expression on energy consumption and removal of nitrogen according to water treatment methods. With this expression, we studied the energy reduction effect of five small and large wastewater treatment plants by concentrating nitrogen removal on large-scale wastewater treatment plants, while ensuring the required amount of nitrogen reduction in the model drainage basin. As the result, it was estimated to be able to reduce about 21% of energy consumption required for water treatment in the whole basin.

In addition, a similar relational expression created with the performance values of statistical data suggested a possibility of inefficient operation in small treatment facilities due mainly to influent load fluctuation since energy consumption in such facilities was higher.

3. Evaluation of carbon-dioxide emissions in reclaimed wastewater utilization

Reclaimed wastewater is valuable as a water resource available even at the time of drought, but energy consumption should be considered in using reclaimed wastewater.

Accordingly, we estimated energy consumption in the supply of reclaimed wastewater using a wastewater reclamation process that includes the membrane filtration treatment, for which development is advancing in recent years. In this estimation, we evaluated energy consumption as carbon-dioxide emissions ($LCCO_2$) since we considered not only power consumption for wastewater reclamation but also the energy used for manufacturing, etc. chemicals consumed in wastewater reclamation. The figure shows an example of such evaluation. As a result, emissions of $LCCO_2$ were smaller in the wastewater reclamation process consisting of "Ultrafiltration membrane (UF membrane) treatment + Ultraviolet (UV) disinfection" than in the conventional wastewater reclamation process consisting of "Prechlorination + Coagulation sedimentation + Sand filtration + UV disinfection," which uses many chemicals. This result also suggests superiority in terms of energy consumption and applicability of the wastewater reclamation by membrane filtration treatment, which had been said to consume much energy.

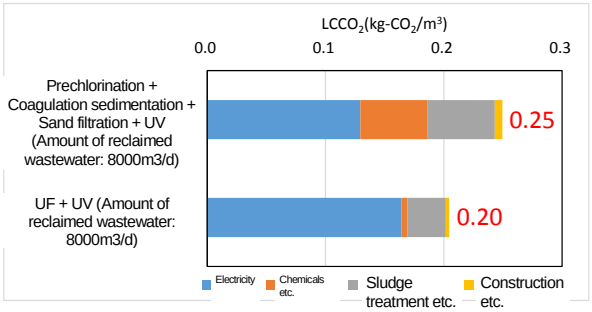

Figure. Example for Comparison of $LCCO_2$ in Wastewater Reclamation

4. Evaluation of hygienic risk control technology for treated wastewater / reclaimed wastewater

We have been studying typical technologies for disinfection and reclamation of treated wastewater in order to evaluate optimal treatment technologies from the two viewpoints of hygienic risk (infection risk) of treated wastewater / reclaimed wastewater and the cost and

energy consumption of treatment technologies. We aim to utilize findings of this study mainly for proposal of treatment technology that controls cost and energy consumption while reducing hygienic risk.