Research Collaboration on Dewatering and Incineration Systems Designed to Achieve Zero Auxiliary Fuel Usage

Year of Research	2009～2013	Establishment of energy and resource recycling

(Purpose)

The reduction of N_2O emissions from a sludge incinerator can be achieved by increasing the incineration temperature. However, this can cause the amount of auxiliary fuel usage to increase, thereby increasing the greenhouse gas emission and operation and maintenance cost. Hence, this method is considered to be disadvantageous.

Meanwhile, lowering the water content of dewatered sludge in an incineration facility is a well-known existing technology, which can reduce the amount of auxiliary fuel usage by self-sustained combustion. However, it is not easy for this method to maintain a stable combustion in the self-sustained combustion range due to the fluctuation of water content and sludge properties.

In this research, the system is re-structured as an integrated system (sludge self-sustained combustion system) from dewatering to incineration. Stabilizing the self-sustained combustion can contribute to the reduction of operation and maintenance cost and greenhouse gas emissions. The purpose of this research is to verify the system by conducting a basic experiment and verification test using the existing facility (50t/day; bubbling fluidized bed furnace) of Hokubu plant in Gifu city and summarize the considerations for planning, design, and operation and maintenance into a technical report.

(Results)

We performed a basic experiment and reconstructed the existing facility until 2012, and summarized the corroborative research work and research results in 2013.

(1) Outline of the sludge self-sustained combustion system

This technology consists of three parts: dewatering technology that produces the dewatered sludge with a low water content of 72±2%, transporting and flow measurement technology that transports the low water content sludge and controls the feeding rate, and incineration technology that provides a stable self-sustained combustion in the incinerator. We added a fluidizing air cooler and cooling fan to the incinerator facility to control the heat input into the inside of the furnace with excess heat due to the self-sustained combustion. We also added a water gun and water sprinklers as emergency cooling systems to manage the rapid increase of temperature within the furnace with self-sustained combustion.

(2) Results of the basic experiment and verification tests

1) It was confirmed that low water content sludge (72±2%) that can undergo self-sustained combustion in the incinerator can be produced using one high polymer coagulant through the application of a double-layer cylindrical filter press.
2) It was confirmed that low water content sludge can be transported by increasing the capacity of the electric motor in the uniaxial screw type pump. At the same time, it was confirmed that we can measure the feed rate of the sludge with low water content in a similar manner to the sludge with normal water content using an electromagnetic flow meter.
3) It was confirmed that a stable self-sustained combustion of low water content sludge can be maintained by controlling the heat input to the incinerator using a fluidized air cooler and cooling fan in the bubbling fluidized bed furnace. It was also confirmed that the temperature inside the furnace continues to be stable when the operation switches from self-sustained combustion to auxiliary fuel operation.
4) The results of emission gas measurements showed that the system can reduce the amount of N_2O emissions by 70% or more compared to operation using auxiliary fuel.

(3) Evaluation

The reductions in annual operation and maintenance cost and greenhouse gas emissions were calculated based on the treatment performance at the Hokubu plant in Gifu city. The annual operation and maintenance cost can be reduced by about 33 million yen and the cost recovery time is about 11 years.

In addition, the calculation showed that greenhouse gas can be reduced by approximately 2,200t-CO_2 annually.

(Summary)

We hope that this technical report is useful in contributing to a reduction in the operation and maintenance cost and greenhouse gas emissions.

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