Joint Research on Biomass to Fuel Conversion Technology for Sewage Sludge Based on Reformed Sludge Drying

Year of Research	2007・2008	

(Goals)

With the reuse of construction materials, compost, and other waste growing slowly, sewage sludge is attracting attention as a biomass fuel which, used as a coal substitute, can cut greenhouse effect gas emissions. Reformed Sludge Drying technology for treating sewage sludge is intended to contribute to the manufacture of fuel products with calorific value equal to or higher than the dewatered sludge which is input, to the effective use of sewage sludge, and to the reduction of greenhouse effect gasses, by altering dewatered sludge by a hydrothermal reaction at high temperature and high pressure conditions (200 to 230 ^{0}C and 1.6 to 3.0MPa) under saturation vapor pressure.

This goal of this study is to verify this technology by performing corroborative testing and to evaluate the performance and safety of the fuel product which is produced, and to prepare a technical manual summarizing technical matters concerning planning, design, execution, and maintenance.

(Results)

The configuration of this technological system consists mainly of ① reforming and cooling equipment, ② dewatering and drying equipment, and ③ drainage and treatment equipment.

Figure 1 shows the basic block flow of this technology and Figure 2 shows its fuel product.

Dewatered sludge is dewatered by liquefying it by a continuous reforming reaction by directly supplied steam then dewatering it to a water content of about 50% with a sludge dewatering machine. Next, a dryer is used to produce the granular fuel product. And the filtrate is processed using a methane fermentation system (UASB) and a membrane separation system (NF membrane) to a water quality which can be discharged into public sewerage. And heat obtained from the cooling equipment is used by the dryer while methane gas produced by the methane fermentation system is used as supplementary fuel to power reforming.

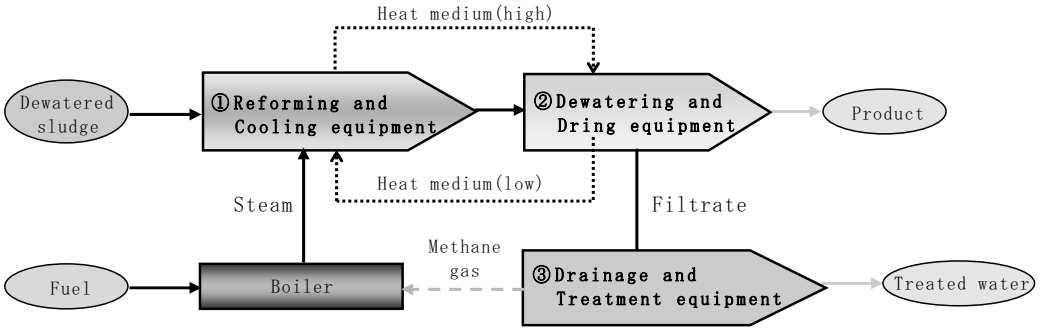

Figure 1. Block Flow

Figure 2 Fuel Product

(Targets)

① Energy balance: generated energy (product calorific value + recovered calorific value)/input energy (electric power + fuel) ≧ 100%

② Calorific value: fuel product/dewatered sludge ≧ 100% (DS base)

③ Treated water quality: BOD 600 mg/L, SS 10 mg/L (sewage discharge standards) or less

④ Cost evaluation: 16,000 yen/t dewatered sludge (LOTUS Project evaluation standard) or less

In addition, the performance of the fuel product was assessed by performing industrial analysis, element analysis, etc. and its safety was assessed by thermal analysis, spontaneous combustibility testing etc.

(2) Results

The corroborative testing was performed using equipment with dewatered sludge treatment capacity of 4.0ton/d, confirming that the target was achieved. And the safety of the fuel product was found to be about equal to that of existing carbonization technology and drying technology. Table 1 shows the calorific value and energy balance results as an example of test results. And during the winter, the results will fall a little short of the target values under the impact of low load operation about 1/2 of the rated quantity.

(3) Preparation of the technical manual

The research achievements will be summarized in the technical manual: Biomass Fuel Conversion of Sewage Sludge Based on Reformed Sludge Drying.

Table 1. Calorific Value and Energy Balance Results

Item		Winter※	Intermediate seasons	Summer
Average calorific value of dewatered sludge	MJ/kg-DS	19.0	18.2	17.8
	MJ/kg-combustible	23.0	22.4	22.1
Average calorific value of fuel product	MJ/kg -DS	18.8	18.5	18.0
	MJ/kg-combustible	25.4	25.1	24.8
Rate of increase of calorific value by reforming	DS base	99.3%	101.6%	100.7%
	Combustible base	110.5%	112.0%	111.9%
Energy balance		101.1%	109.0%	106.1%

※In winter, it was low load operation of about 1/2

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