

Joint Research on Energy Conversion and Reduction of Sewage Sludge Using Hydrothermal Treatment

Year of research

2008~2010

Research of resource and energy in sustainability

(Background & Goals)

Sewage sludge is superior biomass with a high organic material rate of about 80%, but using the organic material as a resource or energy is limited to use on farms and for digestion gas conversion, etc. This research has combined hydrothermal based organic material decomposition technology and high speed digestion technology in order to develop technology which reduces sewage sludge to 1/3 of that of conventional dewatered sludge on an SS base, and which reduces sewage sludge to 1/5 of dewatered sludge by weight. A local production for local consumption cyclical system capable of supplying all the thermal energy which the plant requires using the digestion gas which is produced has been constructed. The goal of this research is to prepare a technical manual based on the achievements of the above research.

* Hydrothermal treatment refers to treatment which uses the high hydrolytic degradation capacity of hot water to convert suspended organic materials to low-molecular weight organic materials.

(Results)

(1) Verification test conditions

- [1] Quantity of thickened mixed sludge treated: 6m³/day
- [2] Hydrothermal treatment retention time: 1 hour
- [3] Hydrothermal treatment temperature: 180°C, 1MPa
- [4] Hydrothermal treatment solid concentration: 7%
- [5] Digestion tank operating conditions: 5 days of retention, 55°C
- [6] Flocculant ratio of mechanical thickening : 1% (compared with SS)

(2) Results of the verification test

[1] Sludge reduction rate (SS base)

The average sludge reduction rate throughout the period of the 2010 verification test was 67%.

[2] Sludge reduction rate (weight base) of dewatered sludge

If the dewatered cake moisture content based on conventional dewatering treatment is considered to be 80%, the sludge reduction rate was 80% (1/5 by weight).

[3] Digestion gas generation (thickened raw sludge:thickened excess sludge = 1:1, 6m³/day, equivalent to influent sewage converted to 800m³/day)

The gas production multiplier was an average of 11.6 (Nm³/m³-mixed sludge). This exceeded the 9.4 (Nm³/m³-mixed sludge) required to operate the plant, confirming that it could supply the total required quantity.

[4] Dewaterability of digestion sludge

The dewaterability of digestion sludge was improved, achieving moisture content of about 65%.

[5] Properties of the recycle flow

The nitrogen component was diluted to about 100 times in the influent sewage to approximately 6.6 (mg/L), and its chromaticity was 34 (standard landscaping use water applicability criterion for technology for use of recycled water (chromaticity of 40 or less)).

[6] Clogging countermeasures

The adoption of periodical water displacement operation (about 2 hours every 10 days) prevents the

occurrence of scale related to clogging inside the hydrothermal reaction.

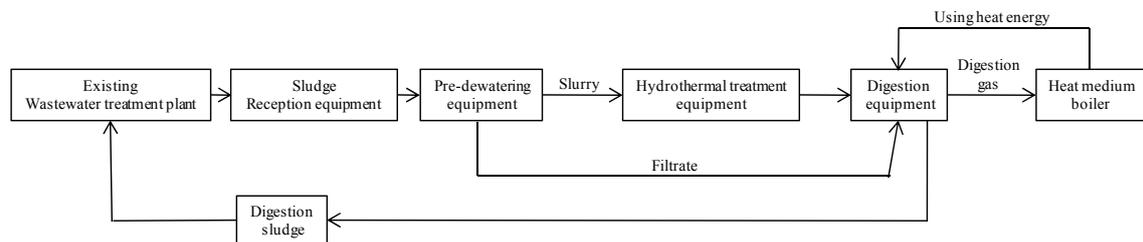


Fig.1 Process flow of verification test

(Conclusions)

A technical manual summarizing the above search results has been issued.

Participants in the joint research: Mitsubishi Nagasaki Machinery Mfg. Co., Ltd., Kajima Corporation, Japan Institute of Wastewater Engineering Technology

Inquiries: Resource Recycling Research Division, Takashi Ishida, Shuichi Ochi, Masayoshi Minami [03-5228-6541]

Key words

Hydrothermal treatment, hydrolytic degradation, sludge reduction, high-speed methane fermentation