Promoting Methane Fermentation Technology for Small-scale Sewage Plants

Ishikawa Prefecture

Background

Methane gas generated by sewage sludge is a greenhouse gas believed to be about 21 times more powerful than carbon dioxide. Utilising methane gas as a renewable energy source to generate electricity and heat helps curb global warming. But methane gas is not effectively utilised at small-scale sewage plants run by municipalities due to cost problems. The Ishikawa prefectural government tried to develop low-cost methane fermentation technology for small-scale sewage plants.

Purpose of Project

In fiscal 2010, the prefectural government launched a joint industry-government-academia project to develop methane fermentation technology for small-scale sewage plants. With the technology close to practical application, the prefectural government aims to share it with other local governments that run small-scale sewage plants in an effort to promote a recycling-oriented society.

Outline of Project

It is an industry-government-academia joint initiative aiming to commercialise methane fermentation technology for small-scale sewage plants. The technology was put into full commercial use in 2014.

Features and Advanced Aspects

The development of technology to churn highly concentrated sewage sludge helped reduce the size of fermenting tanks by one-fifth.

The newly developed fermentation-accelerating technology involves the use of microwaves to modify sludge structure, which helps make methane fermentation more efficient. As a result, costs can be lowered through a reduction in the amount of sludge.

The use of renewable energy source methane gas to generate electricity and heat helps lower operating costs while helping reduce global warming. Sludge that remains after methane fermentation is processed into fertiliser to use resources in a cyclical manner.

Technology to churn highly concentrated sewage sludge

Technology to accelerate sludge fermentation

Effects of Project

Effects Anticipated at Planning Stage

◆The introduction of methane fermentation technology for three small-scale sewage plants at a municipality of about 20,000 people helps reduce the amount of carbon dioxide emissions by 22.7% over 19 years.

◆The development of technology to churn highly concentrated sludge helps reduce the size of a fermentation tank by one-fifth and lower costs.

◆The development of technology to accelerate sludge fermentation using microwaves helps make methane fermentation more efficient, which contributes to reducing the amount of sludge and lowering disposal costs.

◆Efficient fermentation helps generate more methane gas and lower maintenance costs by using the gas to generate electricity and heat.

◆The project helps reduce costs by 14% overall compared with conventional sewage sludge disposal systems.

Problems and Responses

◆Problems

1. Using a methane fermentation facility at a small-scale sewage plant is financially unfeasible because of the small amount of sludge involved.
2. Sludge generated in the oxidation ditch process used at most small-scale sewage plants has a low biological degradability.

◆Responses

1. Processing other biomass, including human excrement and food waste, together with sewage sludge can increase the financial feasibility of a methane fermentation facility by consolidating waste disposal plants and making waste disposal more efficient.
2. Microwave processing increases the biological degradability of sewage sludge generated in the oxidation ditch process.

Outlook

The prefectural government will promote the Ishikawa-model methane fermentation technology among municipalities with small-scale sewage plants. It aims to support municipal sewage management and promote a recycling-oriented society.

Reference URL

http://www.pref.ishikawa.lg.jp/mizukankyo/gesui/ishikawamodel.html *Japanese

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A booth opened by the Ishikawa prefectural government at the 2015 sewage works exhibition in Tokyo

Challenges of Small-Scale Sewage Plants	Key Points and Effects of the Ishikawa Model

(1) Low investment efficiency

The introduction of methane fermentation facilities by small municipalities leads to low investment efficiency because the amount of sludge processed by them is small.

(1) Aggregating sludge and other waste

- Sewage sludge
- Human excrement
- Sludge from water treatment tanks
- Sewage from agricultural communities, known as rural
- Food waste
- Domestic animal waste

Aggregating various forms of sludge

Mixed methane fermentation

- **Securing a sufficient amount of sludge for processing by aggregating various forms of waste from a municipality**
- **Consolidating similar waste disposal facilities**

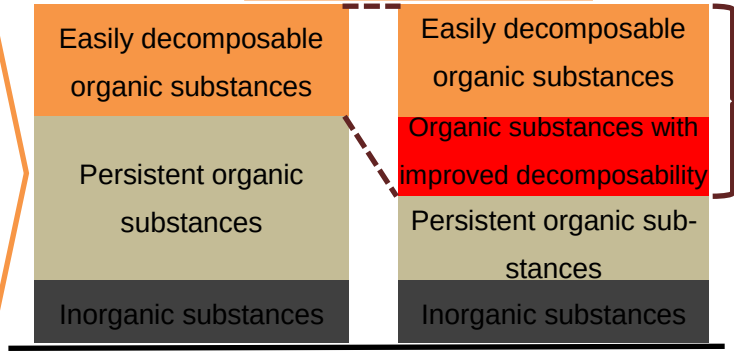
(2) Methane fermentation

Sludge from the oxidation ditch treatment process cannot be reduced considerably and generates only a small proportion of methane gas because of a high concentration of organic substances that are hard to decompose.

(2) Accelerating methane fermentation

Pretreatment of dewatered sludge

Sludge property-improving



The proportion of methane gas generated relative to the total amount of sludge is as high as at a large-scale sewage plant.

- An increase in the amount of methane gas generated
- A reduction in costs for sludge disposal

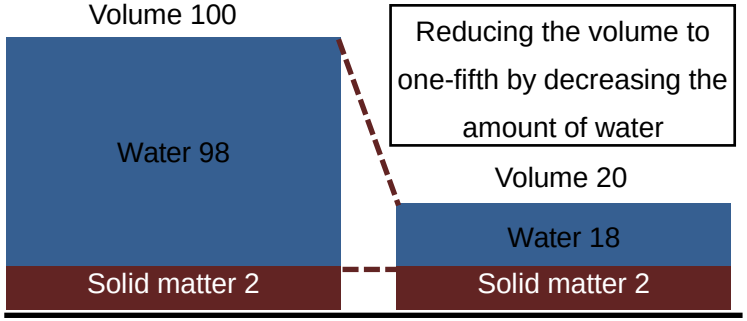
(3) High construction costs

It is difficult to introduce a conventional methane fermentation tank as its construction is costly due to its large size.

(3) Making a fermentation tank smaller

Churning highly concentrated sludge evenly

Making sludge highly concentrated



Lowering construction costs by making a fermentation tank smaller

Process

Several small-scale sewage plants

(1) Aggregating

Dewatered sludge

Other sludge, waste

(1) Aggregating

Methane fermentation using new technology

(2)System to accelerate sludge fermentation

Reducing the amount of sludge further and increasing the amount of methane gas by improving the fermentation ratio

Highly con-centrated sludge

Mixing and fixing

(3) Technology to churn highly concentrated sludge

Making fermenting tanks smaller using technology to churn highly concen-trated sludge evenly

Efficient use of methane gas

- Power generation
- Heat utilisation

Sludge

Efficient use

- Fertiliser
- Fuel
- Construction materials etc.

Disposal by landfill etc.

Transportation and disposal

Increasing volume reductions