

Study on Renovation and Repair of Sewage Sludge Digestion Tanks

Whole term

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(Purpose)

Digestion of sewage sludge is a process that not only reduces the volume of and stabilizes the sludge but it also converts methane gases generated from the sludge into energy. In addition, the digestion is a proven technology with abundant record and is effective in making efficient use of biomass in the entire region. Digestion tanks are operated under severe operating conditions and require periodical renovations and repairs to maintain stable performance. Further, because in many cases there are no spare tanks, they need to be renovated or repaired in a short period of time. However, notes and procedures for the renovation and repair of the tanks have not been established.

This study aims to summarize the technical points and procedures for the inspection, diagnosis, planning, design, installation, and maintenance of anaerobic sewage sludge digestion tanks for renovation and repair.

(Results)

(1) Inspection and diagnosis

A preliminary inspection is first conducted to understand the general condition of the tanks, and then the inside of the tanks is inspected and diagnosed. To inspect the inside of the tanks, the digestion operation needs to be shut down so that the tanks can be emptied. For this reason, it is judged from the following two points whether the inside of the tanks should be inspected or not: (1) presence/absence of abnormal conditions in the tanks and (2) years of operation. Even if there is no abnormal condition in the tanks, the inside of the tanks needs to be inspected within ten years after the start of operation.

(2) Renovation and repair plans

Renovation and repair plans are drawn up in the following steps: (1) study of renovation and repair works, (2) study of the methods for treating concentrated sludge during the renovation and repair works, and (3) study of the work schedule.

The renovation and repair works are broadly classified into corrosion-resistant painting, the work for mixers and the work for heaters that are carried out after sludge in the tanks has been removed. The details of the works are determined depending on the results of the diagnosis of the tanks.

Typical number of days required to carry out the works are listed in Table 1 for the study of the work schedule.

(3) Design

Design for the renovation and repair of digestion tanks is made in the following steps: (1) determine the volume of contents to be removed from the tank, (2) select specifications of corrosion-resistant painting, (3) calculate the required quantity of scaffolding in the tank, (4) select the mixing type, and (5) select a heating system.

Table 1 Number of days required to carry out the works

Work items	Number of days required to carry out the work
(1) Empty contents of the digestion tank	94
(2) Corrosion-resistant painting	84
(3) Equipment renovation and repair work	100
(4) Test run	14
Total	292

Preconditions:

Digestion tank capacity:	4,000 m ³
Scum volume removed from the tank:	300 m ³
Sand volume removed from the tank:	760 m ³

1) Volume of scum to be removed from the tank

The relationship between the digestion tank capacity and the removed scum volume from the tank is shown in Figure 1. The scum volume to be removed is set at about 10% of the digestion tank capacity and about 300 m³ at the maximum.

2) Volume of sand to be removed from the tank

The estimate of sand volume to be removed from the tank is given by the maximum ratio of sand volume to be removed from the tank (to digestion tank capacity), depending on the concentration of concentrated sludge and the mixing type, as listed in Table 2.

3) Mixing types

Mixing is roughly classified into gas and mechanical mixing types. The features of each mixing type were organized. A comparative simulation of mixing conditions was performed and power consumptions of the mixing types were compared.

(4) Installation

Procedures for formulating the scheme of execution, carrying out the renovation and repair works, emptying the contents of the tanks, applying corrosion-resistant paints, carrying out equipment renovation and repair works, performing test run and starting up digestion tank operation, performing construction management and taking safety measures were prepared.

(5) Maintenance

To maintain the functions of the tanks, control items, routine and periodical inspection items, troubles and solutions were prepared.

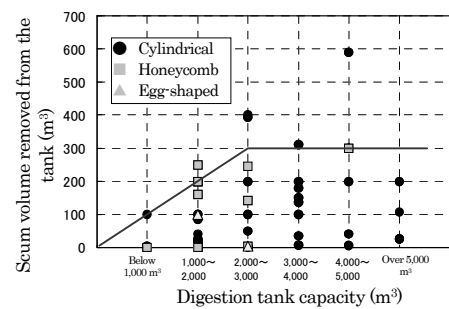


Figure 1 Relationship between the digestion tank capacity and the scum volume removed from the tank

Table 2 Estimate of volume of sand to be removed from the tank

Unit: Ratio to digestion tank capacity (%)

Concentration of concentrated sludge	Below 2%	2-3%	Over 3%
Gas mixing type	10	19	24
Mechanical mixing type	-	7	12

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Key words

Sludge, digestion, renovation, repair