Abstract:

JFE E ee de ed ac d e a ce e a e d e a Jac Sc ce d Tec A c . T ec a de e e a e d e d ea e e ac ac d e a e d e, a ae bac e a, a a , d a c ea . T e a e e c e e ce d e e a a e d dea e a 50.8% ec ed b a ca e a 2.5 3/d, de e a d e e a 30 35 C d e e a 2 da .

1. I d c

Japan generates approximately 2 million tons of sewage sludge each year (by conversion to dry weight). As the sewerage diffusion rate has increased, the amount of sludge has also tended to increase. Sludge reduction/recycling treatment is performed by anaerobic digestion, incineration, sludge utilization for construction material, etc. However, because the construction cost, operation and maintenance cost, and operational cost of treatment facilities are large and landfill sites for sludge are also inadequate, technologies for reducing the generation of sludge and effective utilization of sludge have been demanded.

The sludge generated by sewage treatment systems

in **Tab e 1**.

3.2 A a ca Me d

During the period of the experiment, the properties of the input sludge and treated sludge were analyzed at set intervals. For comparison purposes, digested sludge from an actual facility was sampled and its properties were analyzed in the same manner. The analysis of the solid component was performed in accordance with standard method[3]; volatile fatty acids were analyzed with an ion chromatograph (model DX-120, manufactured by Dionex Corp.), and analysis of the separation column was performed using an IonPac ICE-AS1 (same company). In this paper, the volatile fatty acids were considered to be organic acids, and the mass sum of formic acid, acetic acid, propionic acid, butyric acid, and valeric acid was defined as VFA (volatile fatty acid).

3.3 S dge V e Red c Effec

Changes over time (day) in the SS concentration and SS reduction rate of the input sludge and treated sludge are shown in **F g. 3**. The average composition of the input sludge, acid fermentation-treated sludge, and digested sludge from an actual facility are shown in **Tab e 2**. Here, digested sludge from an actual facility means digested sludge from the Hokubu Sludge Treatment Center. This sludge was generated when anaerobic digestion of input sludge is performed at a planned digestion temperature of 35 C for a planned digestion time of 30 days[4].

Although the SS concentration of the input sludge fluctuates greatly, the SS concentration of the treated sludge was reduced stably. After achieving a steady condition in the tank, changes in the SS concentration similar to fluctuations in the input sludge properties could be seen; however, following the 20th day from the start of the experiment, which was considered to be the steady period, the average SS reduction rate over a 15-day period was 50.8%. As shown in Table 2, the average SS concentration in the acid-fermented sludge during the steady period was 20 500 mg/ , which is virtually the same value as the average SS concentration of 21 100 mg/ in the digested sludge. The SS reduction rate at the actual facility was 49.8% at this time. This value is on the same order as the SS reduction rates obtained at conventional-type digestion facilities. It may be noted that, at conventional-type digestion facilities, the reduced SS is converted to a biogas with CH_4 as its main component, but with this system, SS is converted to soluble organic matter consisting mainly of VFA.

3.4 C d f VFA F a

Changes in the VFA concentration and pH of the treated sludge are shown in **F g. 4**. Based on the data presented in Table 2, the changes in input sludge composition in cases where this system and a conventional digestion process were applied are shown in **F g. 5**. The biogas in Fig. 5 shows the results of a calculation assuming that 100% of the reduced sludge is converted to biogas.

As can be seen in Fig. 4, the rate of VFA formation did not follow the amount of alkali addition in the initial stage of the experiment, and the pH of the sludge was approximately 8. However, pH decreased as VFA forma-

rate of 50.8% was obtained with a retention time of 2 days in the acid fermentation tank. This value is virtually the same as the SS reduction rate obtained at conventional-type digestion facilities. Here, the reduced SS component is organic matter which should essentially be