Methane Fermentation of Night Soil Sludge and Kitchen Waste Mixture

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hydrated using a belt filter and screw press. Fowl droppings are added to the sludge cake in the composting unit, where the temperature is maintained at approximately 60 to promote aerobic fermentation.

(4) Use of gas produced

The gas obtained from the fermentation process is used as fuel in hot water boilers, and energy is recovered as heat. In a practical, large-scale system, fermentation could provide fuel for a gas engine to power an electric generator for energy recovery.

2.2 Test conditions

After trial operation using only sludge for fermentation, a series of tests was conducted under the conditions indicated in **Table 1**. The amount of fermentation material introduced was maintained at 3150 kg/d. Processing performance was investigated by altering the sludge mixture ratio (VTS in the sludge to the total VTS in the fermentation material).

For each run, the run-up period was set at approximately one month, and the test was then conducted for a period of 2 4 weeks while data was recorded.

Table 1 Test conditions

3. Test results

3.1 Properties of fermentation materials

Table 2 shows the composition of the fermentation materials used. An analysis of the kitchen waste and sludge components indicate that the kitchen waste had a high concentration of organic index components, such as VTS and CODcr, carbohydrates, and fats, while the sludge had a high concentration of T-N and proteins.

Table 2 Compositions of fermentation materials (n=10)

n=9

	Item	Unit	Average	Maximum	Minimum
Kitchen waste	pH		4.5	5.3	3.8
	DS		10.4	13.0	9.0
	VTS	dry	90.8	93.3	85.6
	CODcr	mg/L	153600	179600	129200
	NH4-N	mg/L	630	1300	160
	T-N	dry	0.53	0.88	0.40
	Carbohydrates	dry	10.9	26.0	4.0
	Proteins	dry	28.9	34.4	24.4
	Fats	dry	26.0	38.4	20.1
Sludge	pH		7.2	7.8	6.8
	DS		10.0	10.7	9.5
	VTS	dry	69.8	73.9	65.5
	CODcr	mg/L	101600	120000	88300
	NH4-N	mg/L	930	2000	170
	T-N	dry	0.61	0.76	0.50
	Carbohydrates	dry	5.2	10.6	3.9
	Proteins	dry	33.7	40.0	29.8
	Fats	dry	6.0	9.0	5.6

3.2 Fermentation test results

(1) Gas generated

Fig.2 shows the time variation for both the volume of

(2) DS and VTS

DS and VTS concentrations during RUN 2 are shown in **Fig.3**.

Both the DS and VTS concentrations tended to decrease through the process, from the intermediate tank, to the No.1 digester outlet, and then to No.2 outlet. This is due to the decomposition of DS and VTS in the gasification of organic materials during the methane fermentation process. The variation in DS and VTS concentrations in the No.1

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3.3 Characteristics of methane fermentation

(1) Material balance

Table 3 shows the material balance for the digester under the test conditions employed. As shown in the table,

Fig.6 Rate of increase in load due to press water

4. Conclusions

This research was conducted under a technical development support project of the Japan Waste Research Foundation and was a cooperative effort of seven companies. The results obtained may be summarized as follows.

(1) Apart from the short run-up period during which conditions varied, the RENAISSA System® exhibited stable processing performance with only minimal effects of the return of dehydrated press water on the water treatment process.

(2) A considerable volume of methane gas was generated for the amount of introduced VTS - a minimum of 0.5Nm^3/kg-VTS. The two-stage fermentation system designed in-house exhibited satisfactory processing performance.

(3) Compost produced from the residue of the methane fermentation process exhibited a superior fertilizer effect compared to the dried somatic cell fertilizer employed as the control. No evidence of inhibited growth was apparent.

Based on these results, the Japan Waste Research Foundation obtained certification of this process in January 2000 as Evaluation Technology No.23 - Methane Fermentation Technology Using Waste Water Sludge (e.g., night soil sludge) and Other Organic Waste Materials.

This approval should allow the use of the RENAISSA System® to satisfy the expected increase in demand for processes used in sludge recycling centers and provide high levels of processing performance, ease of maintenance and management, and improved economy.

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References

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