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Automated composting toilet system at Asahiyama Zoo

Asahikawa City, Japan

1 General Data

Type of Project:

Bio-toilet system at Asahiyama Zoo

Project Period:

Start of the project: 1997

Project Scale:

Gradual installation of 31 bio-toilets since 1997

Address:

Kuranuma, Higashi Asahikawa-cho, Asahikawa City, Japan

Planning Institution:

Seiwa Denko Co., Ltd.
Hokkaido University (Laboratory of Forest Chemistry, Graduate School of Agriculture, Sustainable Sanitation Laboratory, Faculty of Engineering),

Executing Institution:

Seiwa Denko Co., Ltd.

2 Objectives of the project

- Practical reasons: Replacing problematic conventional toilets by user-, maintenance- and environment-friendly bio-toilets.
- Research and demonstration including the following:
 - a) Monitoring of maintenance and operation, especially regarding degradation of faeces and urine, by operation protocols.
 - b) Awareness rising and obtaining public feedback concerning ecological sanitation.

3 Location and general conditions

Asahikawa Zoo is located in a fairly rural area in the middle part of Hokkaido island and is not covered by a sewage system. Before the establishment of bio-toilet system in 1997, human waste from light construction water toilets was

ECOSAN SYSTEM APPLIED COMPONENTS	SOLID BIOWASTE	FAECES	URINE	GREYWATER	RAINWATER
COLLECTION		Bio-toilet system			
TREATMENT		Automated Composting Reactor			
UTILISATION		Soil conditioner for agriculture			

collected as night soil and disposed using pumping cars. This system posed problems like odour, high maintenance costs (transportation etc.), functional and operational problems (freezing) especially during the winter season with temperatures of -20 to -30°C when also e.g. transport was hindered by high piles of snow. Therefore, the management decided to apply the bio-toilet system (OWDTS) to treat human waste. A feasible sanitation solution became even more important as the visitors numbers had increased to about 2.1 million during the year 2004, said to be eight times as many as in 1996.

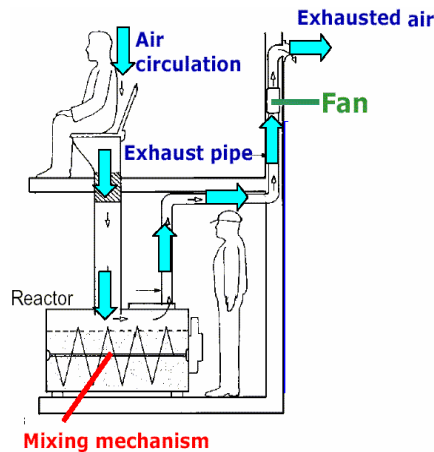


figure 1: Bio-toilet system sketch (source: Seiwa-Denko)

4 Technologies applied

Since 1997, a total of 31 bio-toilet composting units have been installed. A Bio-toilet is an automated type of composting reactor that utilizes sawdust as an artificial soil matrix for biodegradation of human excreta. The system consists of

the following main components: Excreta falls/runs from the toilet bowl and/or urinal to the electronically steered composting reactor. There it is automatically mixed in certain intervals and ventilated. To ensure an optimum temperature for the composting the reactor is electrically heated as far as necessary.

Almost all of the installed bio-toilets in Asahiyama zoo are used to treat both faeces and urine, while few units are just used to collect urine from urinals.



figure 2 : Portable toilets for male and female users (source: Seiwa-Denko)

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Federal Ministry
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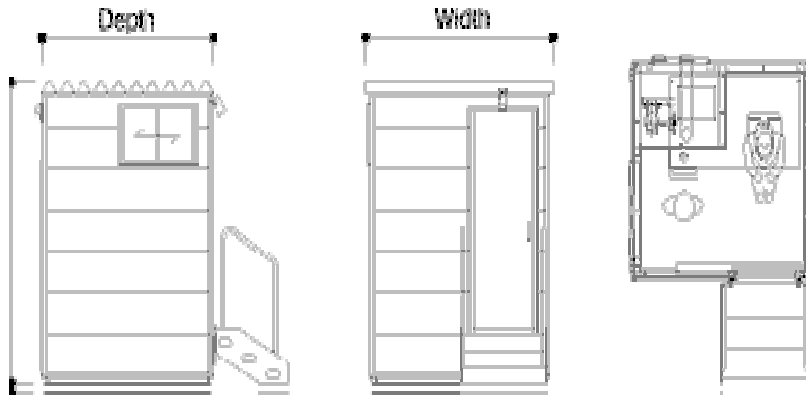


figure 3: Sketch of the portable combined male and female toilet (source: Seiwa-Denko)

Several types of bio-toilet systems are applied:

- Portable toilets : 8 units for both sexes (figure 3) and 8 units for women only
- Permanent toilets: 2 units for handicapped persons, 7 units for women, 6 units for men



figure 4 : reactors of the permanent toilets (source: Seiwa-Denko)

Principally biodegradable garbage can also be treated in the bio-toilet system. Hence visitors are allowed to throw this type of waste into the toilet bowl. Posters at the toilet doors explain the rules, and since people are very disciplined in this regard no problems occurred so far.

5 Type of reuse

The gained compost is rich in N, P, K and a good source of fertilizer. At present a small part of compost is distributed to interested citizens by the toilet company for free. But most of it is brought to stockbreeding firm free of charge, where it is mixed with conditioner and then commercialized as compost. It is applied by farmers as fertilizer to vegetables. Up to now there was no detailed follow up of this processes, but no complaints either.

6 Further project components

Future plans of this project include besides the total replacement of the remaining three Japanese latrines the treatment of the animal manure using the same method.

7 Operation and Maintenance

At present, 6 persons maintain all the units at the zoo. They check the compost once a week, and it is usually withdrawn once a month together with replacement of sawdust. In peak season sawdust is replaced more often, according to visitors' numbers. It is stored at the back side of the toilets. The compost is withdrawn manually before being transported to the stock breeding company. Although a vacuum machine was used before, manual removal was preferred for cost reasons.

The parts of the toilet that are operated automatically (like mixing of compost and heating) require few attention. These functions are monitored by a control system shown in the following picture together with the sawdust storage. They are just checked once in while. In very rare cases motor problems may occur because of very heavy load.

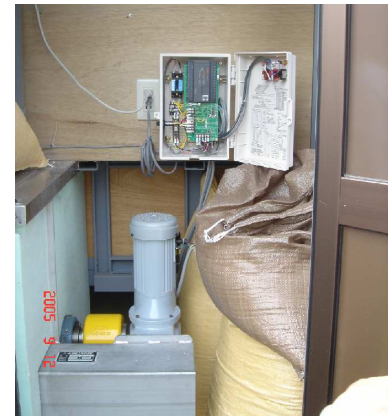


figure 5: the control system of the automated parts and storage of sawdust at the back part of the portable toilets. (source: Seiwa-Denko)

8 Design information and technical specifications

The model used in this zoo is named S-50, which is dimensioned to be used 80-100 times/day while changing the sawdust every six months. Since it is used 200-300 times a day, the sawdust is changed every month.

The method of construction, materials used and other specifications are patented and restricted knowledge of the producer. Basic data can be seen in drawings and on the producer's website (see chapter 10).

Since this toilet solution needs energy supply stand alone solutions with wind mills, solar cells, cycle generators etc. for remote areas are available.

9 Practical experience and lessons learned, comments

During eight years of monitoring so far no problem has been encountered. The zoo authorities can now open the zoo even during winter season because freezing is no longer a problem. Each unit works even at extreme conditions like freezing temperatures. The public accepted it very well, especially since there are no odour problems, which are often encountered in other toilet systems.

Since there are adapted toilet types also for special needs like those of handicapped people or portability of whole units no major limitations have to be faced.

The toilet solution has also been featured in the local newspapers and television networks and received recommendable results

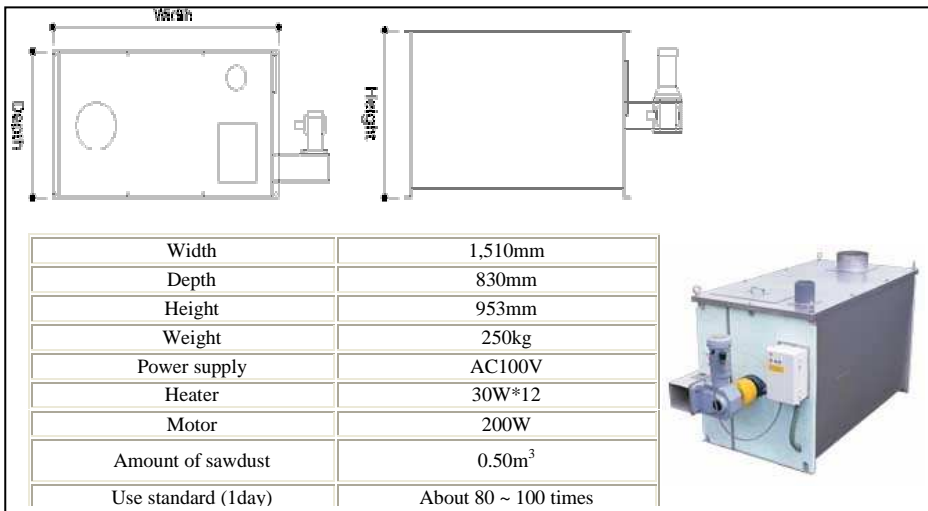


figure 6: Data and picture of reactor S50
(source: *Seiwa-Denko*)

10 Costs

The investment cost for the components of each unit can be seen in the website of the company (see link below).

The investment for all complete toilets was appr. € 42.000. Running costs consist mainly of costs for maintenance personnel and energy costs (presently appr. € 20-25 per month and toilet).

11 Available documents and references

Funamizu, Naoyuki. Development of a Sustainable Sanitation System and its Implementation to Asian Countries: An interdisciplinary research project in Japan Science and Technology Agency. (Contact see below.)

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URL <http://www.seiwa-denko.co.jp>

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data sheets for ecosan projects

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