Re-thinking Toilets in Evacuation Shelters:
Plant-assisted Toilets

W201905: Shizuoka Prefectural Mishima Kita Senior High School

Introduction

Thousands of people are forced to stay and live in evacuation shelters every year in Japan due to natural disasters. However, toilet facilities in local community evacuation shelters are not always ready for use, and this causes inconvenience and threatens the health of evacuees. I have designed an innovative circulation mechanism that makes use of existing toilet facilities and a water treatment system assisted by plants. By examining the water treatment ability of different plants and installation costs, and consulting the local community to meet their needs, I propose plant-assisted toilets with a water circulation system to be fitted in toilets in evacuation shelters.

Research and Proposal

Typical toilet facilities in community evacuation shelters

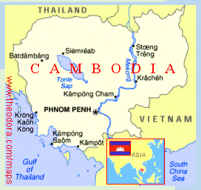
Japan

Photos by Japan Toilet Labo

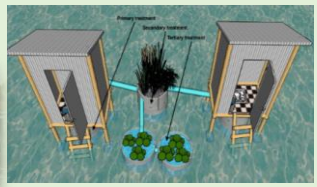
Disposal	Composting	Manhole
		
Plastic bags cover the toilet to collect waste.	Sawdust treats waste.	Waste goes to sewer pipes.
☺ Easy to set up. ☹ Single use. Storage problem.	☺ Less smell. ☹ Expensive.	☺ Direct. ☹ Pipe checks before use.

Existing 6 manhole toilets in Mishima can be modified.

The HandyPod wastewater treatment system in the Lake Tonle Sap



Cambodia



Photos by WaterAid

1. The waste from the latrine pan above the lake water is flushed gravitationally into the plant drum component.
2. Plants in the drum treat the wastewater.
3. Treated water is passed into the lake water.

Method and Evaluation

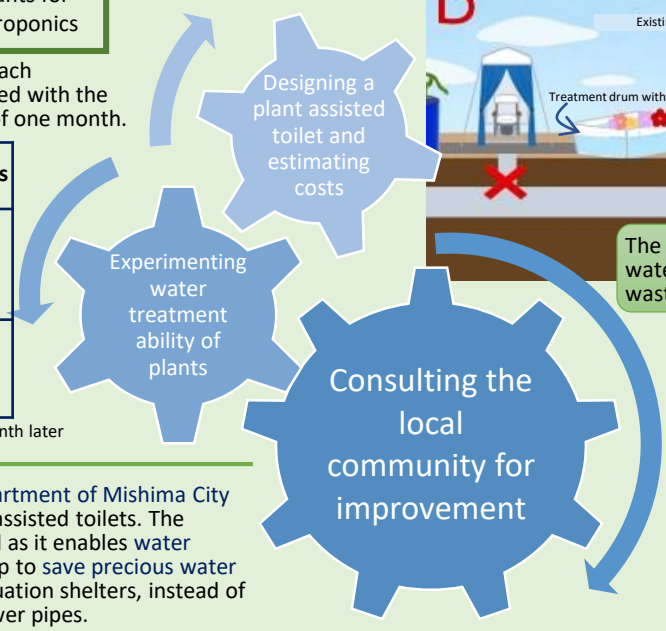
Plant-assisted toilets with water circulation system by making use of existing manhole toilet facilities.

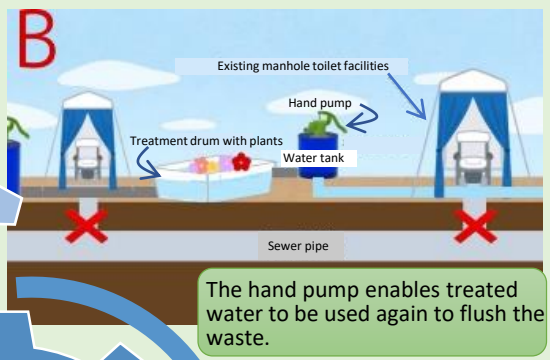
3 plants for hydroponics

COD (Chemical Oxygen Demand) in each contaminated water sample was tested with the Pack Test©, three times for a period of one month.

Hyacinth	White radish sprouts	Pea sprouts
		
COD: 100 ⇒20 ⇒20 (clear)	COD: 100 ⇒100 ※ Died in 2 weeks.	COD:100 ⇒100 ※ Died in 3 weeks.

COD: Original state ⇒1 week later ⇒ 1 month later





The hand pump enables treated water to be used again to flush the waste.

The crisis management department of Mishima City was interested in the plant-assisted toilets. The system was highly evaluated as it enables water circulation, which would help to save precious water resources in the life of evacuation shelters, instead of flushing water down the sewer pipes.

Cost to make a plant-assisted toilet

Items	Cost
Drum (200L × 2)	¥20,000
Water tank	¥8,000
Pipe (×3)	¥2,000
Handy pump	¥1,800
Total	¥35,800

Conclusion

The most outstanding advantage of the plant-assisted toilets I have designed is that the water used in this system recycles and circulates itself. It enables people to use the toilet facilities with only a limited amount of water needed for flushing. Plants which can be used in all seasons need to be found though. Securing readily usable toilets with good sanitary conditions is essential to saving lives. More attention should be given to the management of toilets in the time of disasters. I believe the plant-assisted toilets are one possible option.

Reference

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