Low cost composting toilet for slum area in Asian countries

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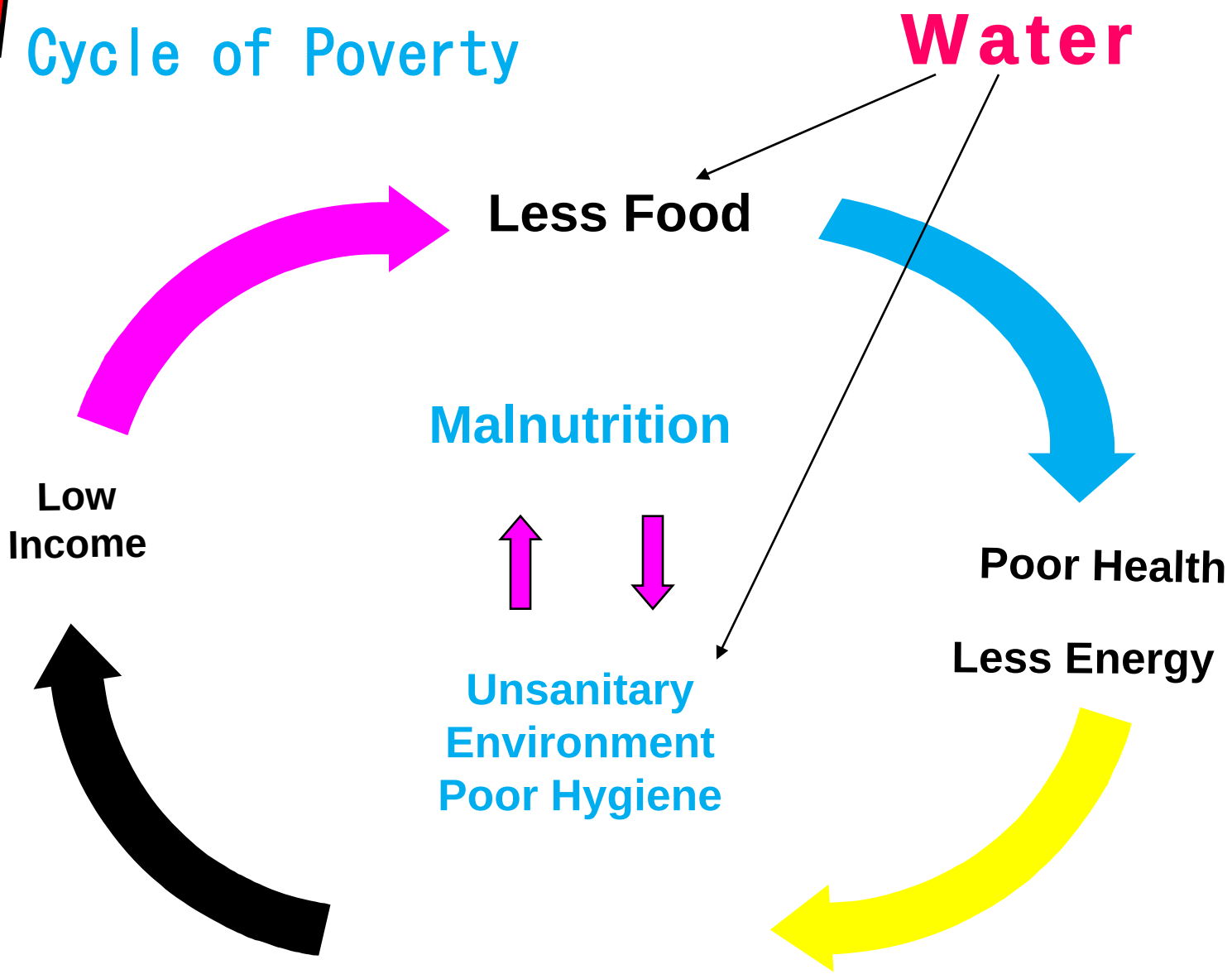
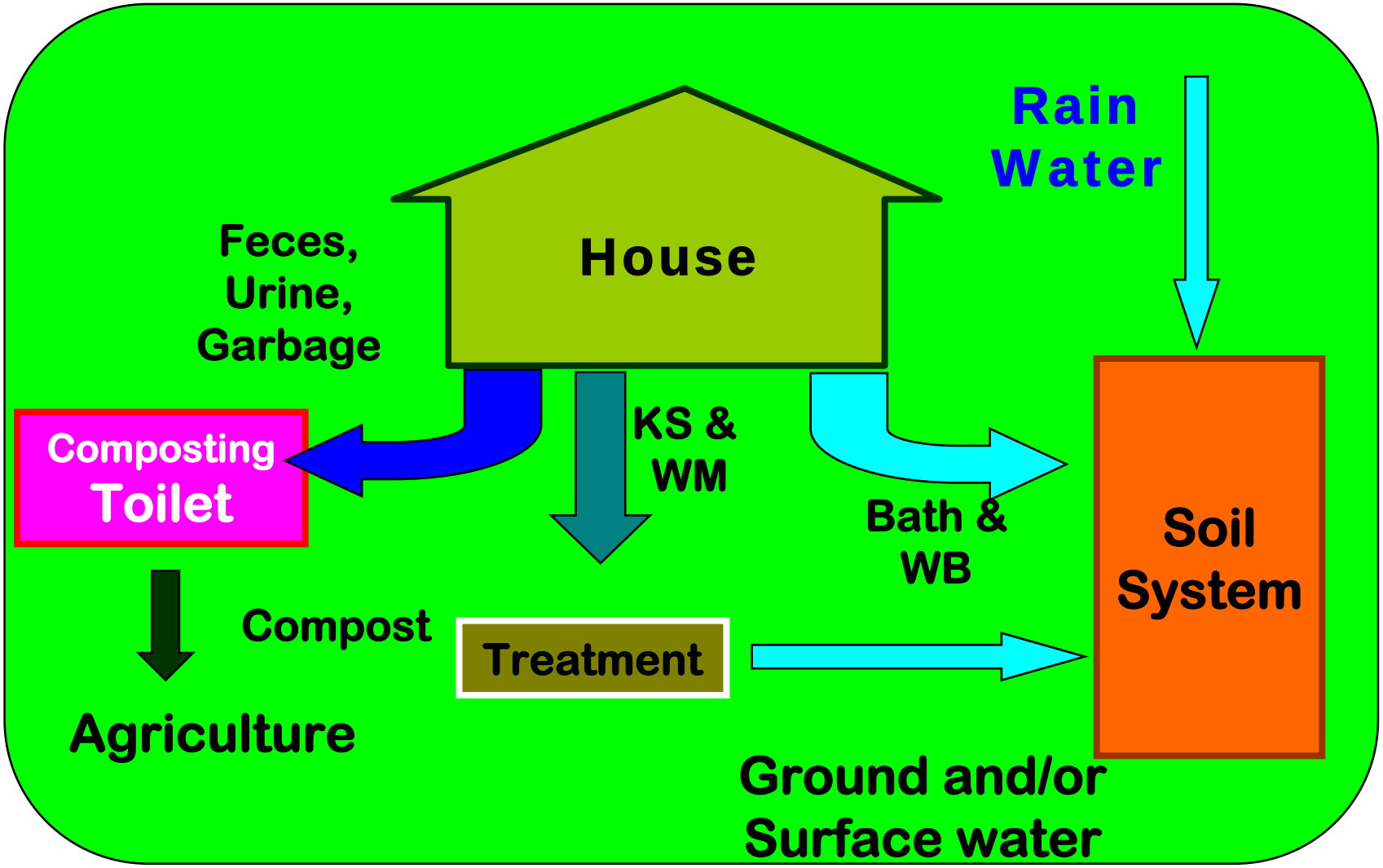
Cycle of Poverty



Two important key words for Wastewater Management

unicef

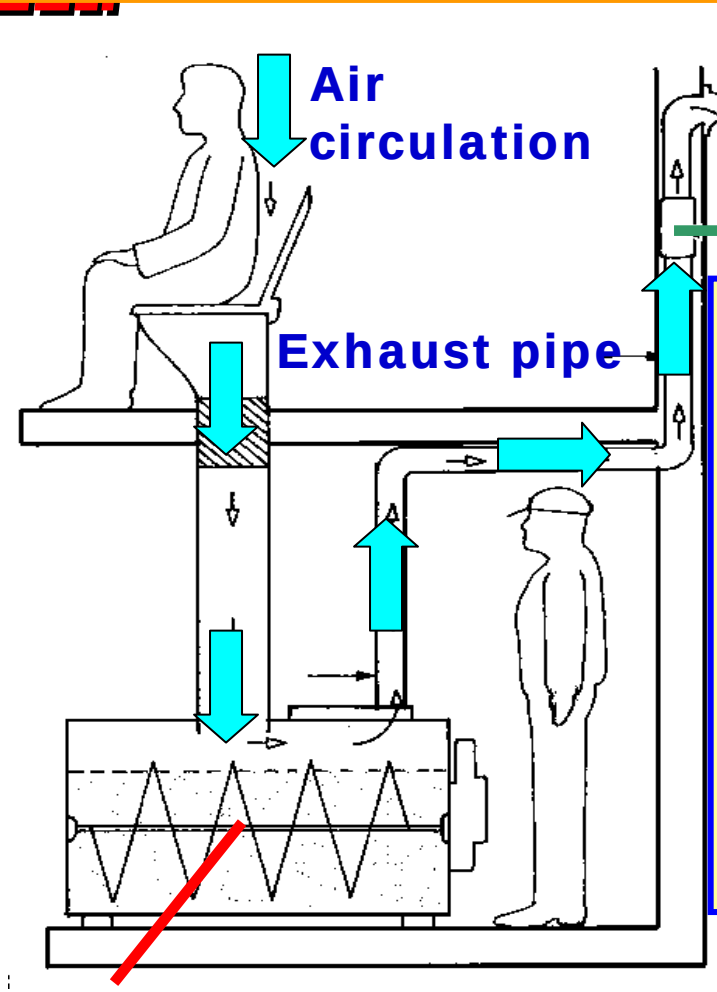
ONSITE WASTEWATER DIFFERENTIABLE TREATMENT SYSTEM



Benefits

- Separating black water gives
  - Recovery and recycle of nutrients
  - Elimination of micro-pollutants in urine
  - Elimination of sources of pathogens
  - Reduction of wastewater flow
  - Conservation of water resources
- On-site treatment gives
  - No requirement of pipes
- The system creates
  - Material cycle (organic matter and nutrients)
  - New social system such as M&O NPO or company.

Composting Toilet



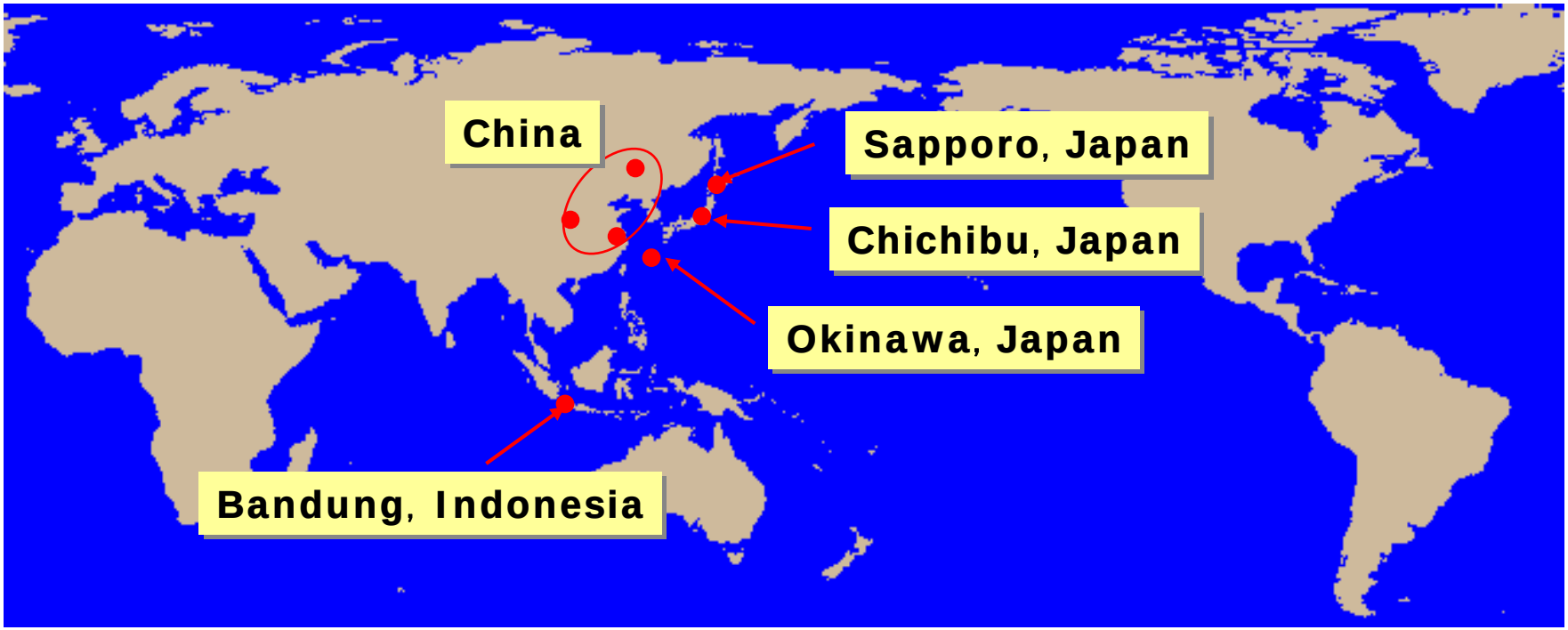
⇨Aerobic fermentation system

⇨No special bacteria and chemicals are used at all.

⇨Sawdust plays important role as an artificial soil matrix.

⇨Aerobic fermentation is performed effectively by mixer and heating system.

Pilot studies



Taihu Lake Basin太湖

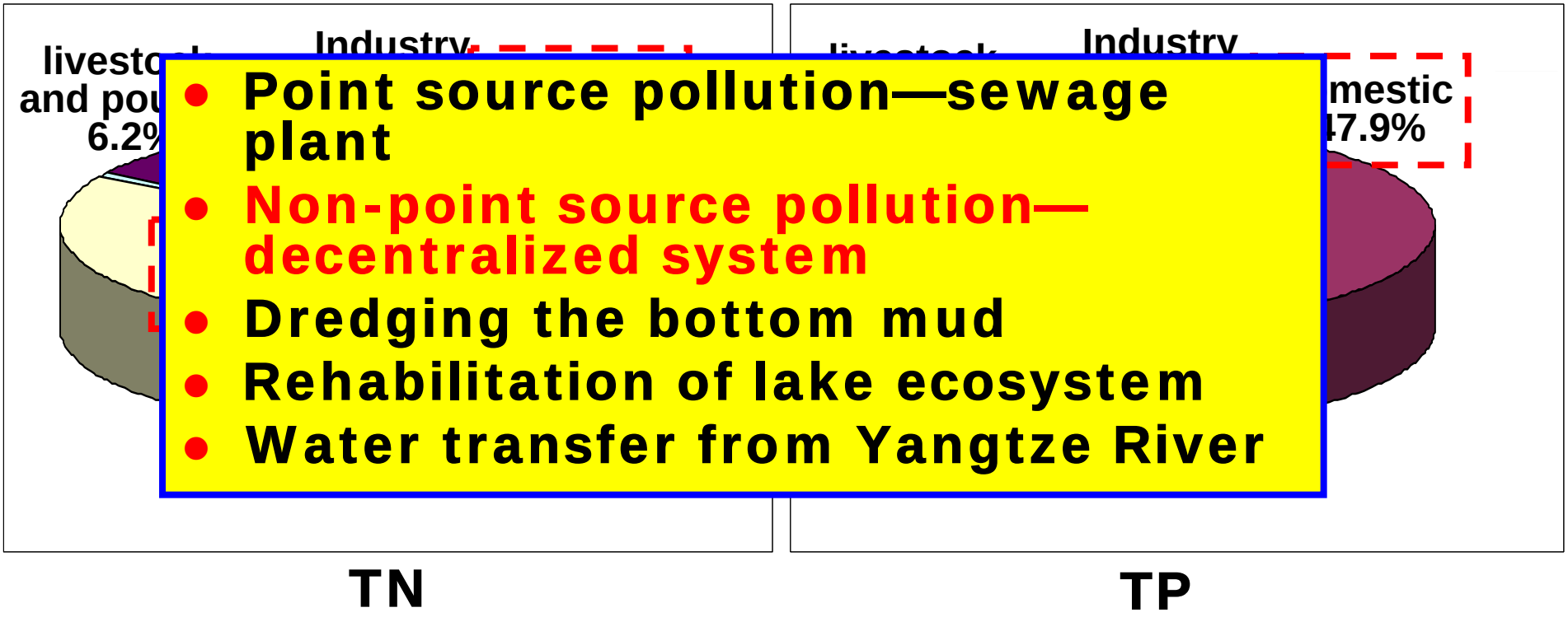
EOS/MODIS May 13, 2007

EOS/MC

- **The algae bloom threaten the water supply of 2.2 million peoples in Wuxi city**

X. Qian, L. Gao, Y. Zhang and G. Lu : The 5th International Symposium on Sustainable Sanitation Tokyo, Japan(2007)

Pollution Source from the Basin



- **Point source pollution—sewage plant**
- **Non-point source pollution—decentralized system**
- **Dredging the bottom mud**
- **Rehabilitation of lake ecosystem**
- **Water transfer from Yangtze River**

Domestic Pollution:

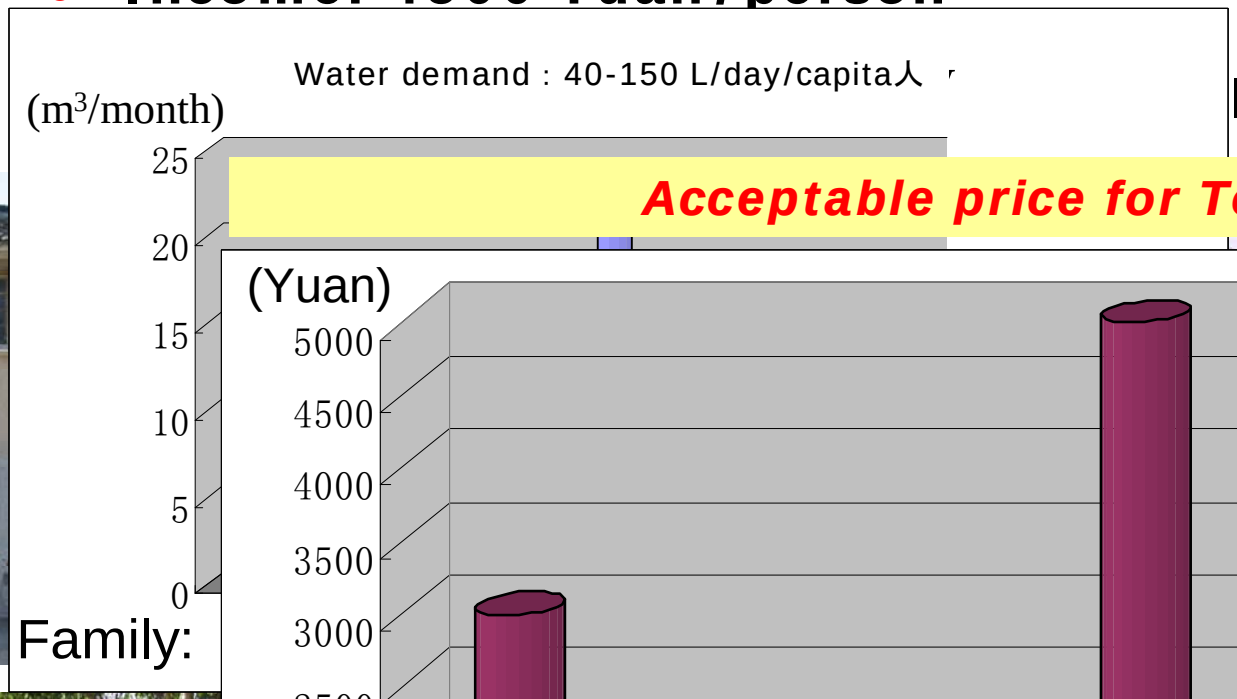
TN: 32911.7 t/a, from town: 77%, from countryside: 23%

TP: 7477.10 t/a, from town: 58%, from countryside: 42%

X. Qian, L. Gao, Y. Zhang and G. Lu : The 5th International Symposium on Sustainable Sanitation Tokyo, Japan(2007)

Survey of families in country side

- **Income: 4500 Yuan/person**



led

Acceptable price for Toilet

X. Qian, L.
Tokyo, Japa

Changchun 長春

- The farmers of Jiangjia village in Helong town(2006.10);
- The fields for breeding the cattle and poultry in Shuangmiao village of in Buhai(2006.10)
- The small company in the suburb of Changchun (2007.5).

Toilets in Jiangjia village

Brick and concrete

Wooden and corn stalk

Concrete and brick

Bian Hongfeng, He Chunguang, Sheng Lianxi, Liu Wei: The 5th International Symposium on Sustainable Sanitation Tokyo, Japan(2007)

The income and expense

	Contents	Explaintation	Unit	Money (Yuan)
	Gas	Fuel in Summer(4jars)	70Yuan/jar	280
	Power	For lighting and appliance(720kwh)	0.5Yuan/kwh	360
	Unpredicted fee	Payout occasionally	500Yuan/year	500
Total				9690

- People understood Composting Toilet
  - Toilet produces Organic fertilizer
  - Corn stork is effective as an matrix
- But, nobody will not install Composting Toilet
  - High cost
  - High O&M cost (mainly for Electricity, 65 Yuan/month is required. Current usage is 25-30Yuan/month each family)

Bian Hongfeng, He Chunguang, Sheng Lianxi, Liu Wei: The 5th International Symposium on Sustainable Sanitation Tokyo, Japan(2007)

Indonesia, Bandung

Septic tank

Effluent: NH_4-N 322 mg/L,
PO_4-P 120 mg/L, COD 172 mg/L

Indonesia, Bandung

- **Initial cost** : **Rp.2,100,000- 4,100,000** for toilet construction cost (except for labor cost)
- **Running cost** : **Rp.12,500-50,000/month** for cleaning septic tank

Break down list

	Person	Income	Water bill	electricity bill	Garbage bill	To clean septic tank
①	5	2500	150 (6.0%)	150(6.0%)	2.5(0.1%)	
②	4	1700	17.5 (1.0%)	70(4.1%)	2.5(0.1%)	
③	6	1700	90 (5.3%)	75(4.4%)	2(0.1%)	12.5-50
④	4	300	18 (6.0%)	20(6.7%)	2(0.7%)	(0.5-16%)
⑤	6	1600	50 (3.1%)	80(5.0%)	2.5(0.2%)	

(1000Rp/month)

Development of low cost Toilet

Minimum Requirement

Low cost

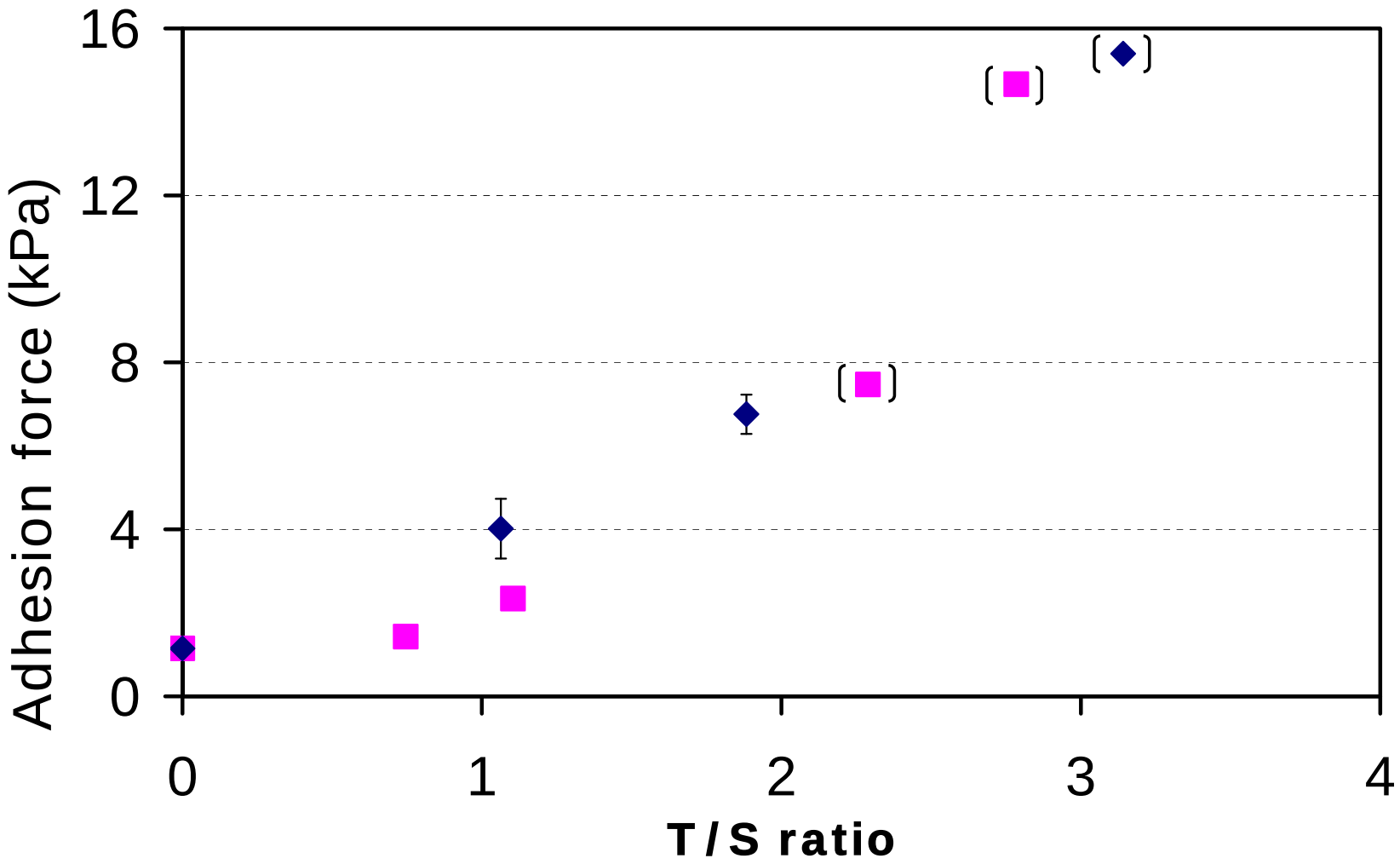
No electricity requirement

Toilet with

- **urine diversion**
- **hand-mixing device**

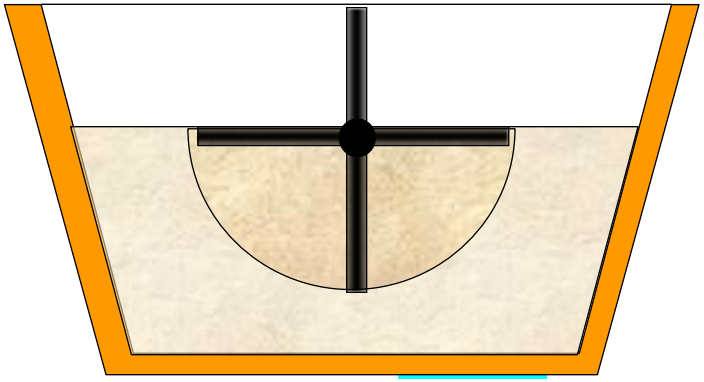
K.USHIJIMA, M. IRIE, N.SINTAWARDANI, J.TRIASTUTI, T.ISHIKAWA: The 5th International Symposium on Sustainable Sanitation Tokyo, Japan(2007)

Design of Composting Toilet

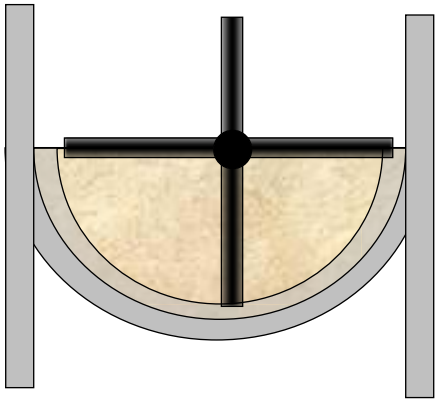


This figure is prepared by Dr. Itoh and Mr. Ino

Prototype

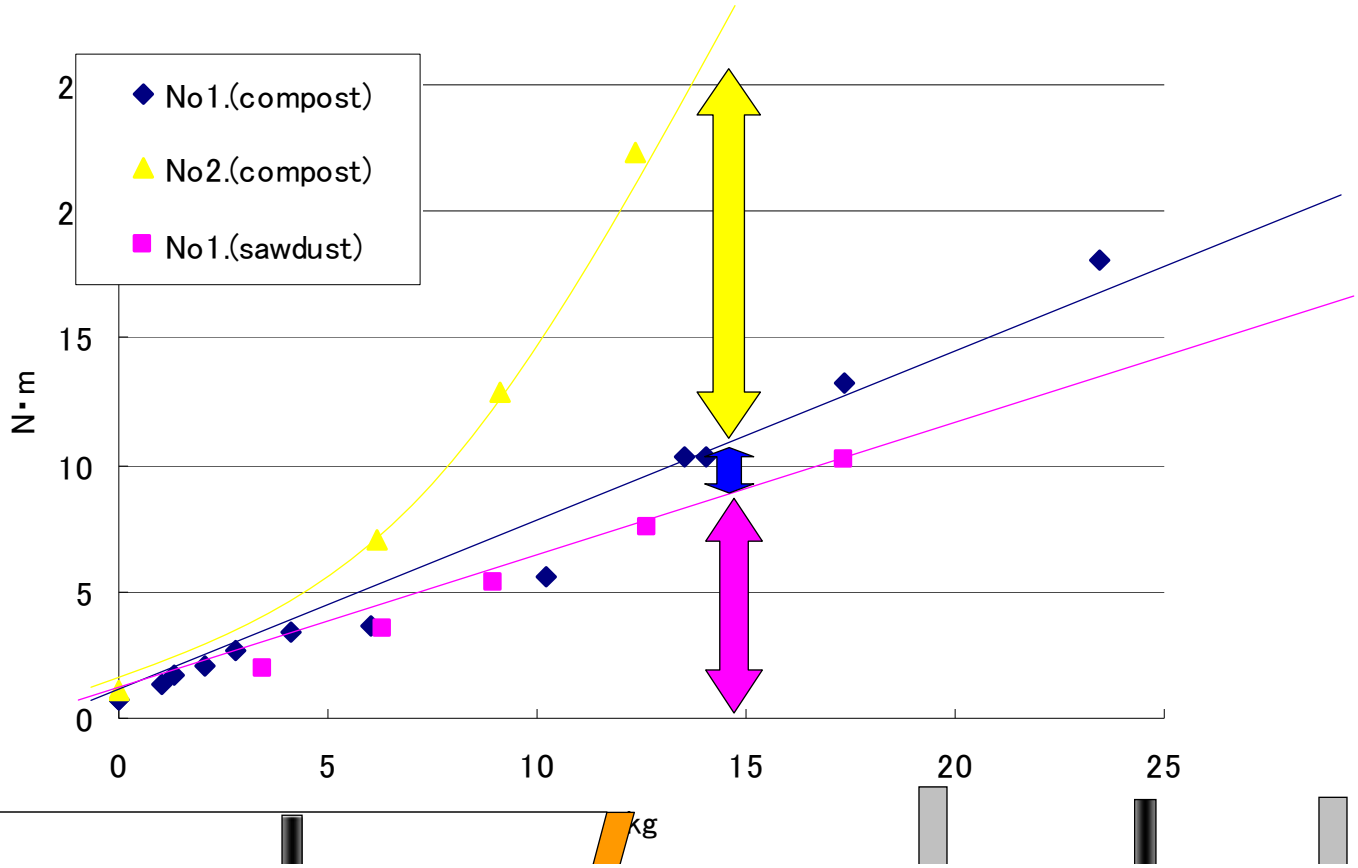


Prototype No.1:
Rp.3,354,500



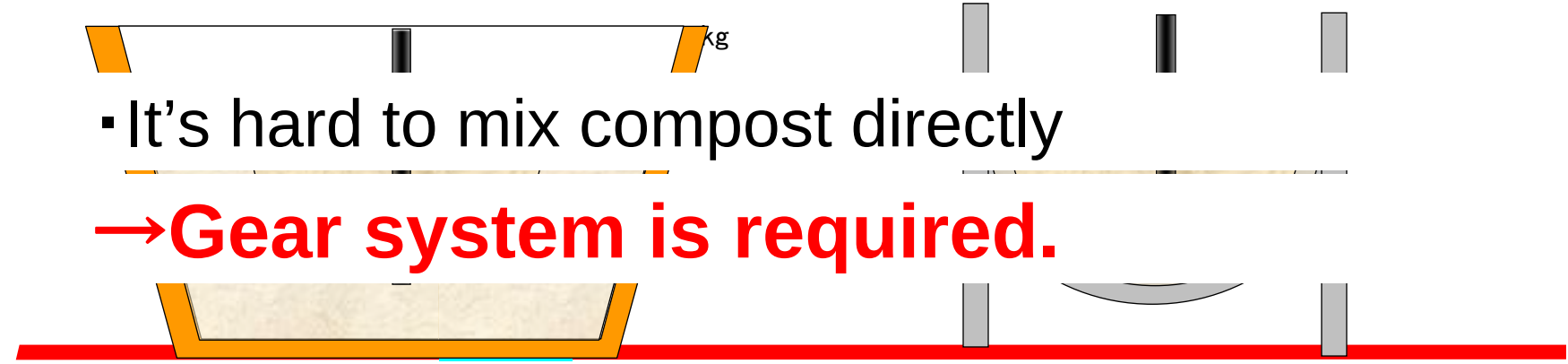
Prototype No.2:
Rp. 7,364,450

5. Prototype



・It's hard to mix compost directly

→Gear system is required.



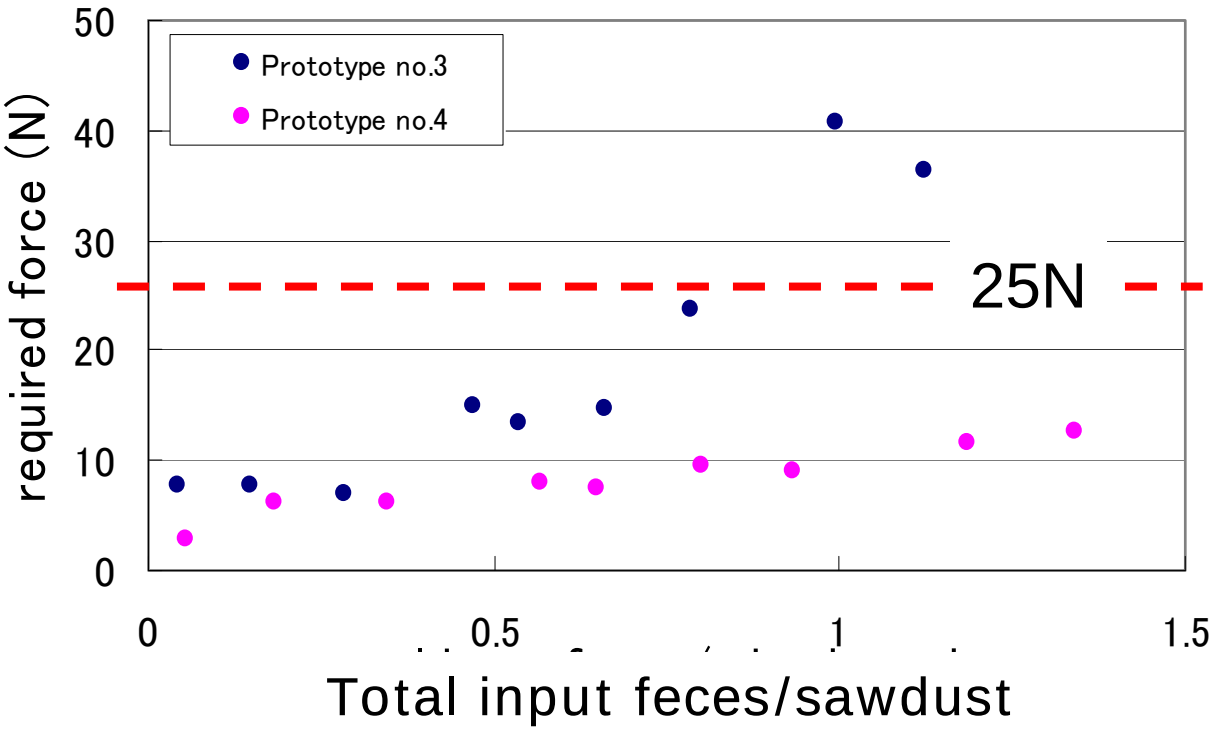
Prototype No.1

Prototype No.2

Prototype

Prototype No.3

Prototype No.4



- No.3: **For one and half months**
- No.4: **For 6 months**

Evaluation

Status

- no input water
- feces: 150gx4 person /day
- mix compost 4 times /use

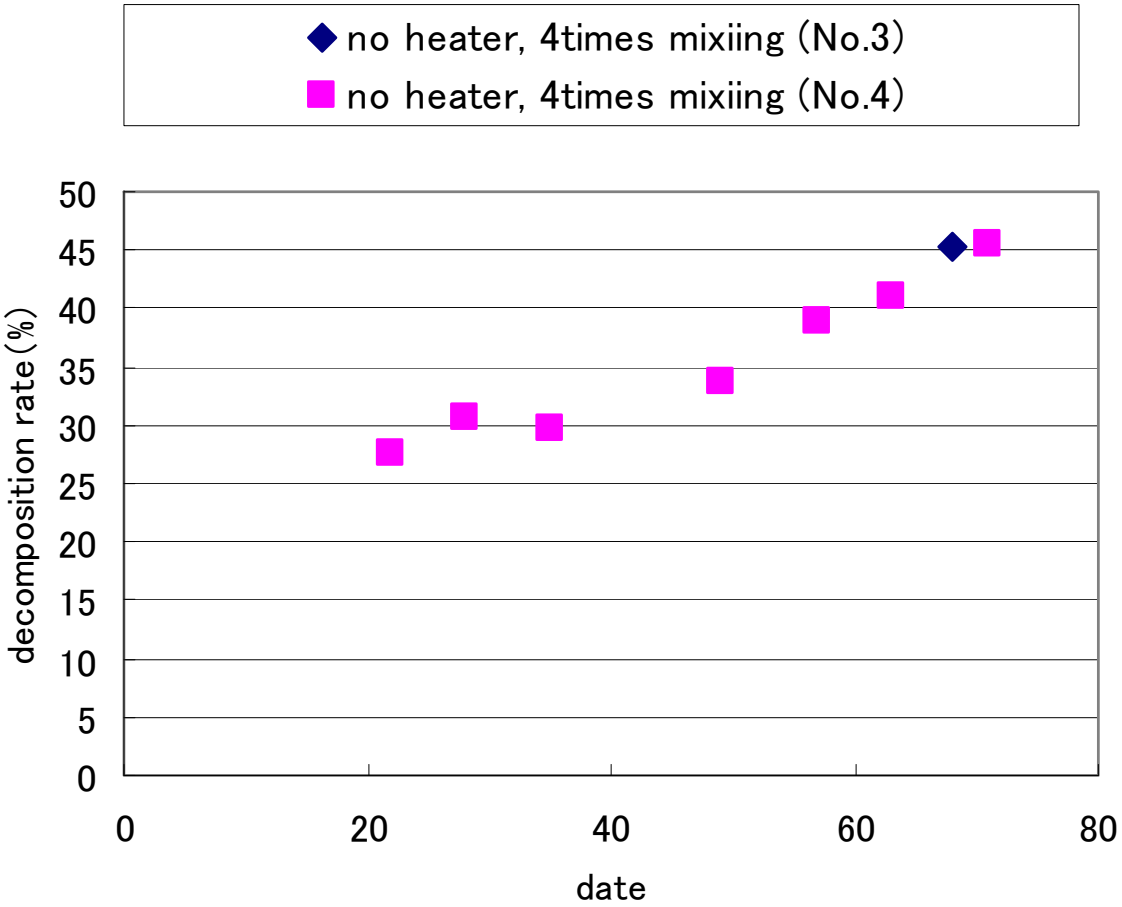
Evaluation

- Treatment capacity → **Decomposition rate**
- Aerobic condition → **Organic acid**
- Inactivation of pathogen → **E-coli & coliform count**

Decomposition rate

Decomposition rate(%) = (input feces– actual weight)/ input feces

45% (Prototype No.3), 45% (Prototype No.4)



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Organic acid

- Information about “aerobic or anaerobic” condition.

→ Organic acid concentration is very low.

E-coli& Total coliform count

Total Coliform count: 10^2 - 10^4CFU/ g-dry

E-coli: 10^4 - 10^5CFU/ g-dry

→calcium oxide: 8-16g and 1 hour retention time.

Conclusion

Urine diverting & hand-mixing composting toilet is feasible option at slum area.

- Required condition, the culture, space and cost for toilet, were summarized.
- Running cost was adequate level with today's garbage collecting system

Prototype of low cost composting toilet was manufactured and operated.

- Prototype cost ranges Rp.3,500,000- 10,000,000.
- Feces was well-decomposed without heating.

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Thank you very much