What is Fukuoka Method ?

in case of Tafaigata Landfill

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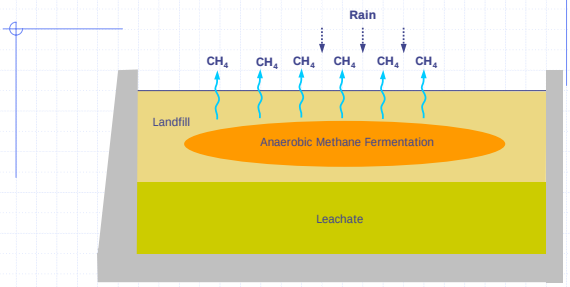
Background

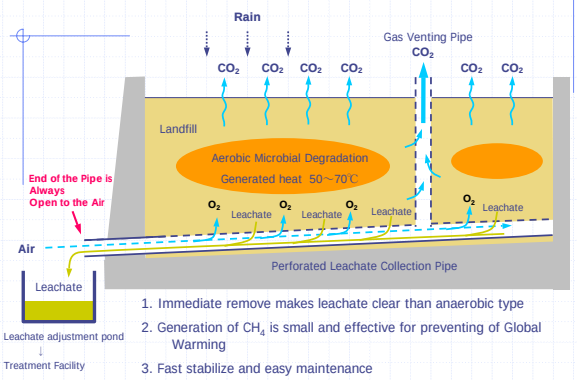
1. Landfill structure in most of developing countries are Anaerobic type (Open dump) and generate methane gas (CH_4) continuously.
2. Most of developing countries have much precipitation. It makes decomposition slow and lead to Anaerobic condition.
3. About 30% of CH_4 has been generated from landfill.

Anaerobic Landfill structure (Conventional type)



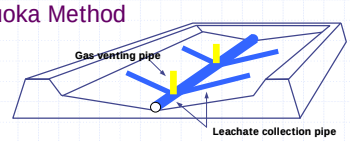
1. Promote Global Warming in generation of Methane Gas (CH_4)
2. As rubbish is dipped in leachate, decomposition is slow in anaerobic condition
3. Contaminate underground water

Semi-Aerobic Landfill structure (Fukuoka Method)



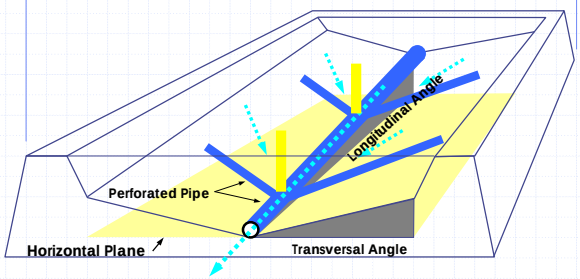
1. Immediate remove makes leachate clear than anaerobic type
2. Generation of CH_4 is small and effective for preventing of Global Warming
3. Fast stabilize and easy maintenance

Structure of Fukuoka Method



- Leachate is collected in a leachate collection pond through perforated pipe embedded in graded boulders.
- As the outlet of main leachate collection pipe is always open to air, fresh air is down into the layers thereby introducing an aerobic condition around the pipes.
- Since leachate is removed as quick as it is formed, the internal waste layer have lower water contents.

Leachate flow on the bottom of the rubbish layer



Leachate flows toward less resistance for down the stream.

Perforated pipe can discharge leachate immediately.

Merit of Fukuoka Method

1. structure is very simple and low cost
   - available for local materials such as;
     Bamboo, Waste Drums, Waste Tires, etc.
2. decomposition is fast and sanitary
   - less odor
   - smooth for after land use
3. leachate treatment become easier
   - quick removal of leachate make it clean
4. can rehabilitate existing dumpsite to sanitary landfill

Concepts of Fukuoka Method for developing countries

are;

1. Low cost
   Tafaigata case US$ 400K
2. Easy maintenance
   Minimum energy use
   Using natural cleansing effect
3. Sustainability

Tafaigata Landfill Site

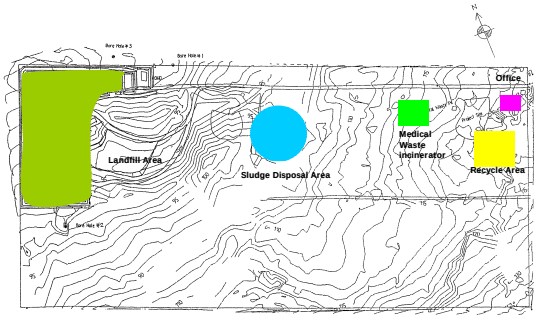
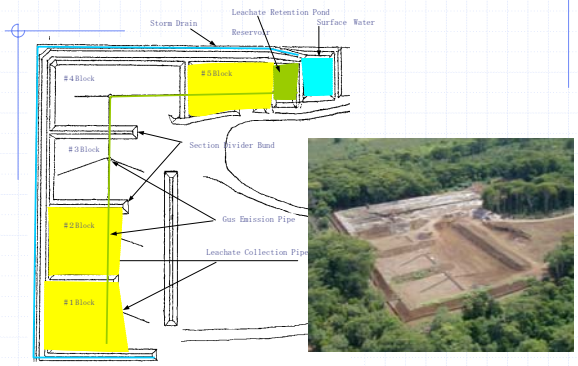


Fig.1 General Layout of Tafaigata Area

Structure of Landfill



Perforated Leachate Collection Pipe

Perforated Gas Venting Pipe

Example of using local materials

China

Malaysia

Mexico

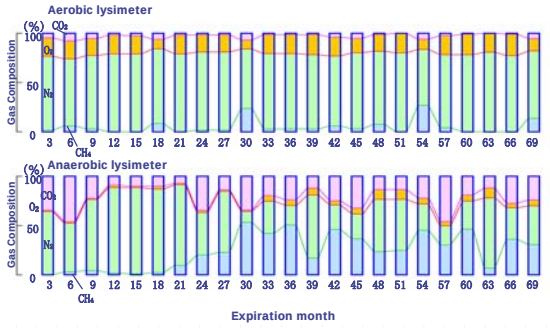
Leachate collection pipe using bamboo and waste tire.

Gas Venting pipe using waste oil drum

Effects of Fukuoka method on Global Warming

1. Fukuoka Method can transform Methane gas(CH_4) to Carbon Dioxide(CO_2)
2. CH_4 has 21 times higher effect on global warming than CO_2
3. Emission of green-house gas from Semi-Aerobic type landfill is 54% smaller than Anaerobic type.

Effectiveness of Fukuoka Method - Greenhouse Gas Emissions

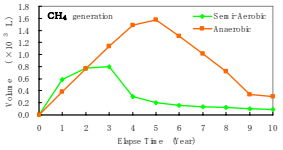


- Main gases released from landfill site ... CO_2, methane, ammonia, hydrogen sulfide, etc.
- Gas composition ... Depends on waste decomposition mechanism of site.

Change of Gas Emission

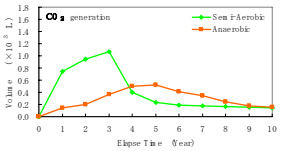
Semi-Aerobic type

- Decomposition begins at the early stage and peak of decomposition is 3 years after.
- After 3 years decomposition gradually converge

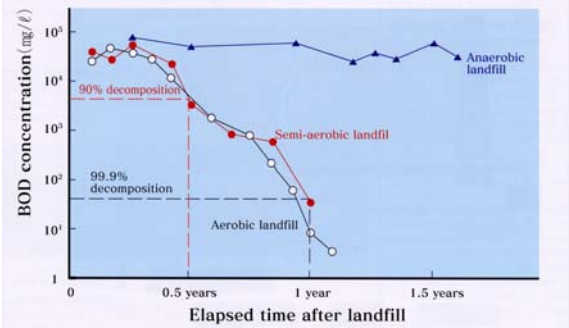


Anaerobic type

- Decomposition begin gradually and peak is 5 years after, then decomposition gradually converge
- Amount of CH_4 generation is large.



Effectiveness of Fukuoka Method - Leachate Treatment-



Modification of Leachate after 1 month operation

Leachate is modified with Oxygen.

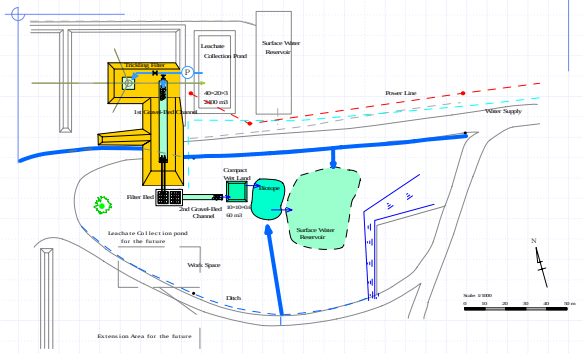
3/Oct/2005

5/Nov/2005

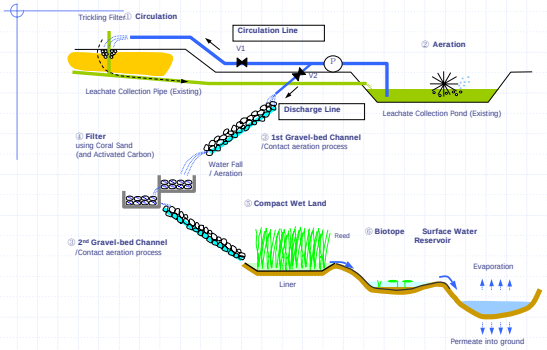
Aerial View

April, 2005

Leachate Treatment Facility



Leachate Treatment



Natural Cleansing Effect

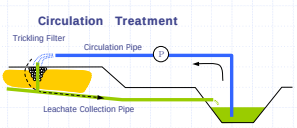
In the river wastewater is clarified at downstream by microbial degradation

We adopt natural cleansing effect for leachate treatment because:

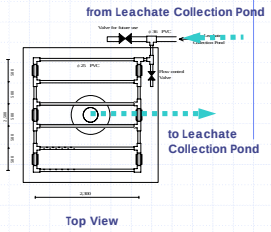
1. simple
2. low cost
   especially running cost
3. easy maintenance

Circulation treatment using Trickling Filter

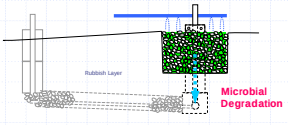
Trickling Filter



Circulation Treatment



Top View



Cross Cutting

Aeration

Provide oxygen to the Micro Organism and promote microbial degradation

Gravel-bed Channel

Micro Organism attached to rocks decompose organic substances

Filtration

Using local materials for filter i.e. Coral tip, Coconut husk activated carbon.

Compact Wet Land

Using indigenous aquatic vegetation i.e. reed, sedge etc. for absorption of Nitrogen and Phosphorus.

Tafaigata , Samoa

Fukuoka , Japan

Fa’afetai lava
Thank you

JICA SPREP