

Final Presentation

Short-term Program

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2. Study outcomes
3. My experiences in Japan

1. Introduction



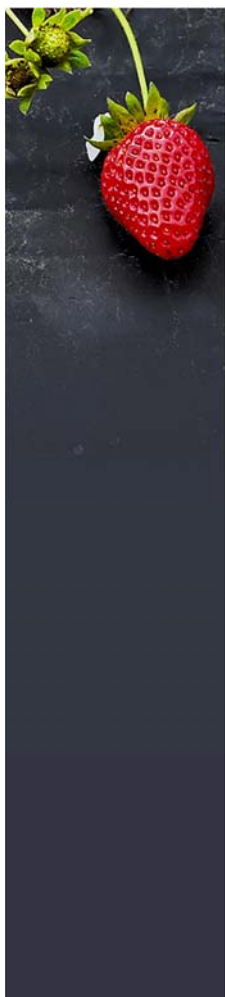
Studying time: from April to September 2015

Japan:

- Supervisor: Prof. Takeshi KATSUMI
- Laboratory: Katsumi's Laboratory
- Affiliation: Environmental Infrastructure Engineering, GSGES, Kyoto University
- Research topic: Evaluate the adsorption performance of GCL (bentonite) in comparison with composite GCL (zeolite and bentonite); and rebuild literature about semi-aerobic landfill (Fukuoka model)

Vietnam:

- Supervisor: Assoc. Prof. Nguyen Thi Anh Tuyet
- Affiliation: Department of Environmental Management, INEST, Hanoi University of Science and Technology
- Research topic: Researching on a semi-aerobic landfill (Fukuoka model) and its application in Vietnam



2. Study outcomes

2.1. Adsorption performance of GCL

2.1.1. Background

2.1.2. Materials

2.1.3. Results

2.2. Semi-aerobic landfill

2.2.1. Semi-aerobic landfill structure

2.2.2. Apply in Vietnam

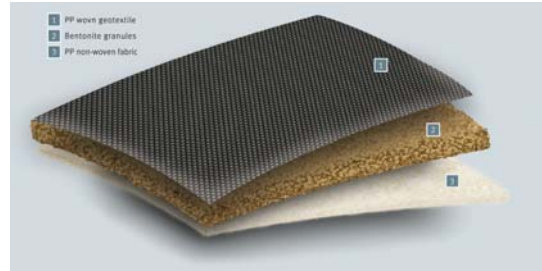
2.2.3. Researches and applications in the world

2.1. Adsorption performance of GCL

2.1.1. Background

What is Geosynthetic Clay Liner (GCL)?

- A hydraulic barrier
- Consists of 3 or more layers of geosynthetic:
 1. PP woven geotextile;
 2. Bentonite granules;
 3. PP non-woven fabric
- Has a very low hydraulic conductivity



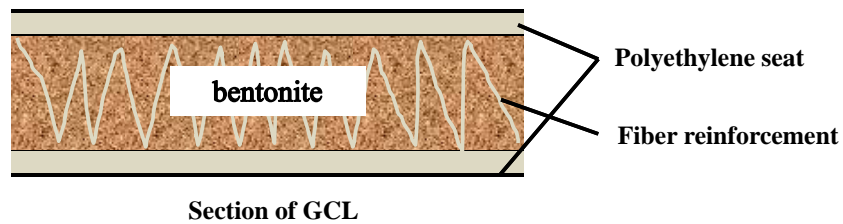
Used of GCL's

- Generally used in municipal solid waste landfills

Removal of Cs from concentrated aqueous solution by Ca-bentonite

- The nuclear disaster cannot be resolved, or at least the resolution will be very difficult
- As radiation is released, polluted waste turns into radioactive waste
- Incinerated garbage ash and sewage mud containing radioactive cesium
- Smectite minerals (present in bentonites) sorb Cs very well. The metal cations are very easily ion exchanged with hydrated cations Na^+ , Ca^{2+} , K^+ and Mg^{2+} present in the interlayer of the smectites

2.1.1 Background



Section of GCL



Issue : evaluate Cs adsorption behavior of GCL

Test method

Bach test
(generally)

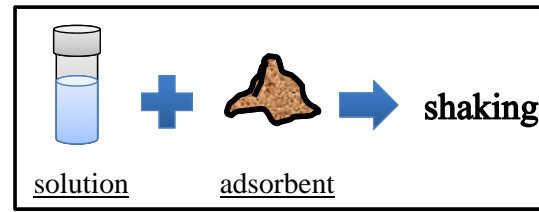
Column test

2.1.1. Background



Batch test

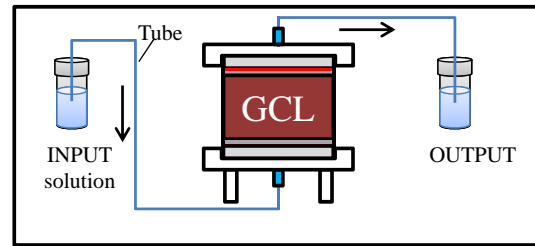
The test is conducted by mixing materials completely. So the result may be not same as field.



Batch test

Column test

Column test can simulate the field condition by passing solution to GCL



Column test

RESEARCH PURPOSE

1. Evaluate the adsorption performance of GCL (bentonite)
2. Compare the result of composite GCL (zeolite + bentonite)

2.1.2. Materials



1. GCL

The basic physical properties of GCL					
		unit	GCL-ZB	GCL-W	Bentofix
Geotextile	Surface layer	g/m ²	Non-woven (220)	Non-woven (300)	Non-woven (300)
	Middle layer	g/m ²	-	Non-woven (200-300)	-
	Under layer	g/m ²	Woven (110)	Woven (200)	Woven (200)
Zeolite	Mass per unit area	g/m ²	2,000	2,000	-
	Nature water content	%	-	5.8	-
Bentonite	Mass per unit area	g/m ²	2,000	3,000	5,000
	Nature water content	%	-	10.1	10
GCL thickness		mm	3~4	8~9	5~6
Hydraulic conductivity		cm/s	1 × 10 ⁻⁷	3 × 10 ⁻⁹	2 × 10 ⁻⁹

2.1.2. Materials



2. Solutions

Solutions used in this study

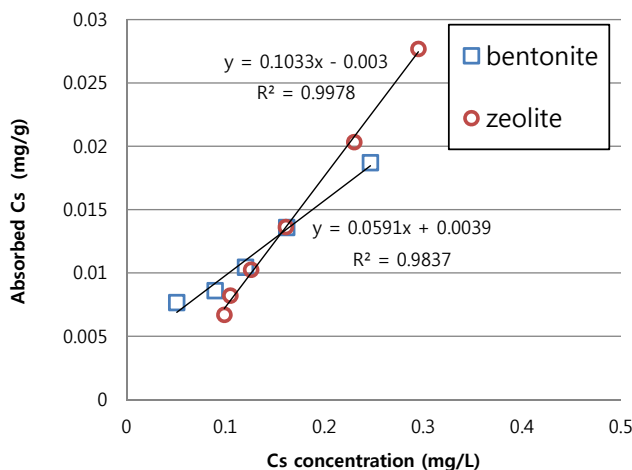
Solution	Mole C (M)	Ion (M)	pH	EC(S/m)	Cs concentration* (mg/L)
Distilled water	0	0	7.0		1.05
CaCl2	0.1	0.2	6.8	1.6	1.02
Leachate	-	-	12.4	3.8	0.43

* Measured by atomic absorption

Simulated leachate

	K (mg/L)	Na (mg/L)	Ca (mg/L)	Cd (mg/L)	Mg (mg/L)	Pb (mg/L)
Leachate	4118	2622	4253	0.030	0.064	0.241

2.1.3. Results: Batch tests



Material	Solution	Distribution coefficient (mL/g)
zeolite	Leachate	103
bentonite	Leachate	59

Absorption isotherm

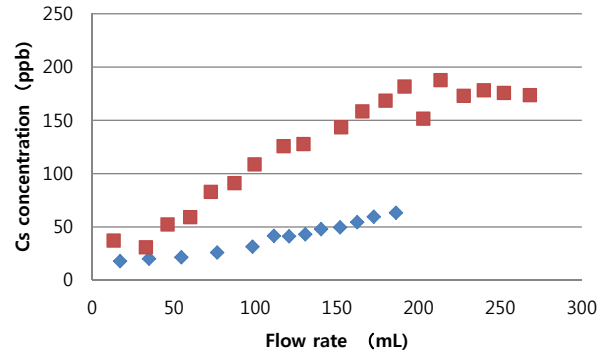
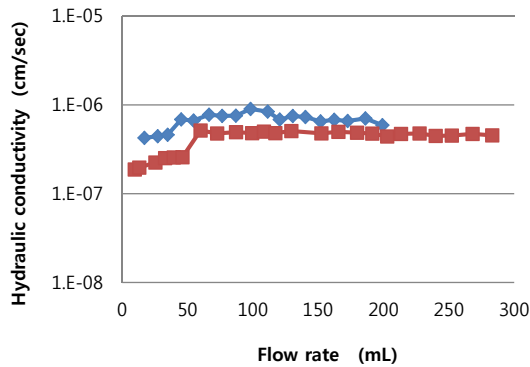


- Distribution coefficient of zeolite is higher than bentonite
- However, because the data is limited, more cases of batch test is necessary

2.1.3. Results: Column tests



1. Leachate (Initial concentration of Cs:450ppb)

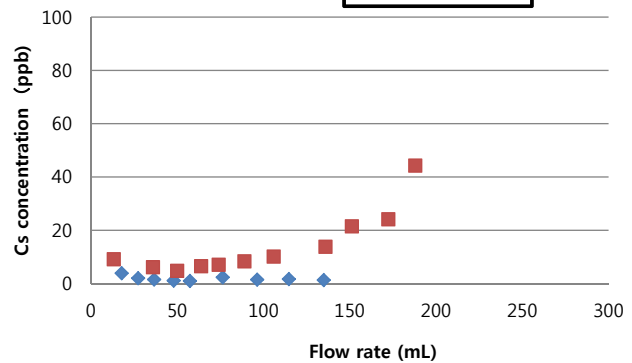
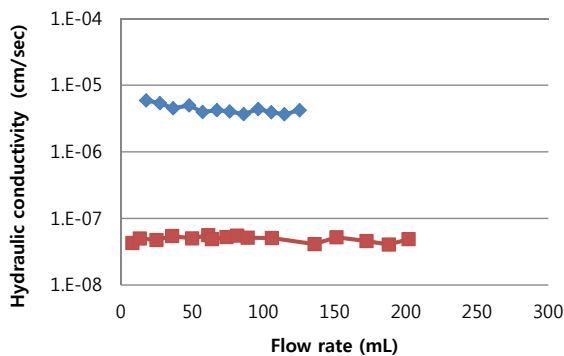


- Hydraulic conductivity (HC) of GCL-W is higher than Bentofix, and the HC in both of them are increased about 2 order compare to distilled water cases. Perhaps due to the non-rehydration of bentonite
- Ca concentration of bentofix in outflow increased quickly than GCL-W in present time. It is indicated the sorption capacity of GCL-W is greater than Bentofix.

2.1.3. Results: Column tests



2. Ca solution (initial Cs:1000 ppb)



- HC of Bentofix is in order of 10^{-8} cm/s, HC of GCL-W increased up to 10^{-6} cm/s. Considering the amount of bentonite in GCL-W is lower than Bentofix, the higher HC of GCL-W may be contributed to the lower amount of bentonite.
- Cs concentration of Bentofix started to increase. However the Cs is almost absorbed in GCL-W in the present time. Also indicated the higher sorption capacity of GCL-W

2.2. Semi-aerobic landfill

The reason we choose semi-aerobic landfill

Comparison among semi-aerobic method and other conventional methods

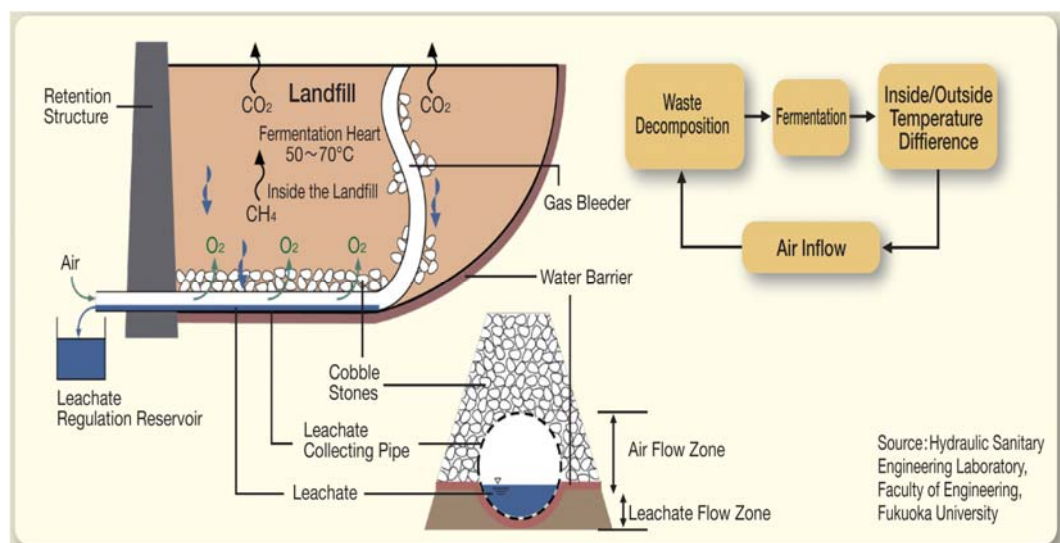
Item	Anaerobic landfill	Improve sanitary landfill	Semi-aerobic landfill	Aerobic landfill
Construction cost	Good	Good	Good and low	Negative and high
Operation cost	Good	Good	Good and low	Negative
Decomposition	Negative	Negative	Good and short	Good and short
Stabilization	Negative	Negative	Good and short	Good and short
Methane gas generation	Negative	Negative	Good and small	Good and small

(Source: Matsufuji, 2007)

Requires amount of moisture and temperature (15 to 40 degree) and the Tropical Region meets these conditions

2.2.1. Semi-aerobic landfill structure

Mechanism of semi-aerobic landfill structure



2.2.2. Application in Vietnam

Dinh Vu landfill, Hai Phong Province, 2010

Xuan Son landfill, Son Tay District, Hanoi City, 2014



2.2.3. Researches and applications in the world

- Many countries in the world applied semi-aerobic landfill type in conducting the waste landfills
- Most of these studies and researches I have read belong to Malay s or were studied in Malaysia (26/41 papers)
- 25/26 papers mentioned about how to treat the landfill leachate b y physical, chemical or biological techniques. This is the good re ference source for Vietnam in solving the problems from semi-ae robic landfill when apply.

3. My experiences in Japan



- I have a very good condition for living like fresh air, fresh and safety food, security house. Even when I went home at midnight the streets are totally safety
- I have a very good condition for studying. In our laboratory, we have every equipment we need with very specific manual. My lab-mates are the best people. They are very friendly. They shown me everything I need to know in lifetime or studying. Many thanks to them!
- In Japan, I have learnt how people work. They work every time if possible. They only go home whenever they finish their work. They plan for a long time after, and they follow this plan exactly.
- I have many experiences in Japan, but I keep this for my own. Whenever someone asks me which country should they come, it's Japan.

Thank you!

