The Republic of Indonesia
Indonesia Institute of Science Innovation Center (LIPI)

Verification Survey with the Private Sector for Disseminating Japanese Technologies of Eco-friendly Concrete Products to Develop Infrastructure

Summary

August 2016

Hakko Industry Co., Ltd.

I. BACKGROUND

In Indonesia, as the economy has grown, the quantity of wastes has increased. Open dumping of waste has been banned under the waste management law in 2008. However, industrial wastes such as oil palm sludge accumulate heaps of open and/or illegal dumping because of insufficient budget for proper treatment such as incineration and therefore, cause environmental problems. In 2010, the Government of West Java Province standardized the waste sanitation landfill treatment at final disposal site and built intermediate treatment facilities and a new final disposal site in West Java Province.

In addition to the challenges against wastes from households and industries, there are a variety of natural disasters like eruptions that produce a huge amount of volcanic ash, cause debris flow disaster and damage the nation seriously. Under these circumstances, the Government of Indonesia settled "National Action Plan for Disaster Risk Reduction 2010-2012" and "National Disaster Management Plan 2010-2014" for disaster preparedness, and "Master Plan Acceleration and Expansion of Indonesia Economic Development 2011-2025" for infrastructure development. In accordance to the Country Assistance Policy for Indonesia, the Government of Japan advocates infrastructure development including disaster prevention and anti-disaster measures.

Through the research and development on the solidification technology by Hakko Industry Co., Ltd. (hereinafter abbreviated as "HIC") since 1998, they invented an additive agent named "YHR Liquid" to solidify various materials. By utilizing this self-developed solidification technology, HIC produces Super Light Stone (hereinafter, abbreviated as "SLS") Blocks for the purpose of contributing to the reconstruction after natural disaster such as volcanic eruptions, earthquakes and floods. There are 2 advantages of SLS Blocks; firstly SLS Blocks is produced from debris, thus producing SLS Blocks could both reduce and reuse the debris generated by the natural disaster. Secondly, SLS Blocks is light and easy to cut into various shapes. This character contributes to reduce the workload and time executed at the construction site as it is easy to handle.

Through the Survey, HIC will produce SLS Blocks locally and verify its quality, feasibility, and superiority in comparison with other concrete products in local market. Their aim is to contribute to solving the development issues in Indonesia with their solidification technologies.

II. PRACTITIONER

Japanese Side: Hakko Industry Co., Ltd.
Indonesian Side: Lembaga Ilmu Pengetahuan Indonesia
(LIPI: Indonesian Institute of Sciences)

III. DURATION

February 2015 – September 2016

IV. PURPOSE

HIC aims to contribute to solving the development issues in Indonesia such as waste reduction and construction of disaster resilient infrastructure by utilizing their YHR liquid. The YHR will produce environmentally conscious concrete products (SLS Blocks) since it recycle wastes including coal ash generated by manufacturing industries and/or volcanic ashes that cause environmental problems in the country. The following outcomes are expected: SLS Blocks is accepted by Indonesia government and local engineer's skill of SLS Blocks manufacturing is improved. In the future, the awareness on environmental protection and disaster prevention will increase among the general public.

V. IMPLEMENTATION POLICY

1. To establish the manufacturing process utilizing waste such as coal ash and volcanic ash as raw material in order to produce competitive SLS blocks in terms of quality and price compared with local existing products.
2. To promote technical transfer to stakeholders of LIPI to realize the dissemination and establishment of sustainable business for the solidification technology of concrete owned by HIC.
3. To develop the dissemination model which corresponds to the local legal restrains through proclaiming the superiority of the product in quality, price and construction and sharing such information with related organizations and stakeholders in construction industry.

VI. ACTIVITY

(1) Equipment Procurement

The following equipment was provided. A set of molding equipment for the production of SLS blocks was procured from Japan after duty exemption and basic enforcement work and installation work were conducted by the local supplier. Moreover, after installation, operation training was done by Chiyoda Machinery Corporation, the manufacturer of the molding equipment.

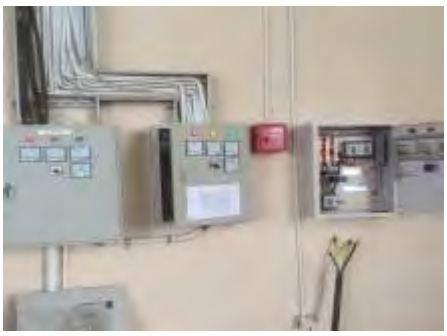
Fiqure1 Equipment List

No	Item	Description	Quantity	Date of Handover
1	A set of Molding Equipment	DF-15SP	1	31 August 2016
2	A set of Mortar Mixer	0.2m3(200L)	1	31 August 2016
3	Ruck	Copper made	1	31 August2016
4	Distribution board	3φ4W(3W) AC380V×3、ELCB3P100mAT,60mAT, 50mAT	1	31 August2016

A set of Molding Equipment

A set of Mortar Mixer

Ruck



Distribution borad

（2）Raw Material

Coal ash was used as raw material for SLS blocks. Although coal ash is specified as B3 waste in Indonesia, it was confirmed with the Ministry of Environment and Forestry that there was no problem in the usage of coal ash for the project by conducting the TCLP testing of coal ash sample and confirming the safety.

Figure2　Flow of coal ash handling

Figure3　Result of TCLP Test for SLS block

Laboratory Sampel Number				OSL 1604020-1	Blank Sampel	Accuracy
Customer Sampel Identity				Paving Block		
Matrix				Solid (TCLP)		
Parameter(s) of Analysis	**Detection Limit**	**unit**	**Method**	**Result**	**Result**	**Result (%)**
Arsenic (As)	0.001	mg/L	HVAAS by USEPA Method 7062 (1994)	0.003	< 0.001	93
Barium (Ba)	0.02		FAAS USEPA Method 7000B (2007)	< 0.02	<0.02	91
Boron (B)	0.03		APHA edition 21nd Method 4500-BC (2005)	0.38	<0.03	101
Chromium Hexavalent (Cr+6)	0.002		USEPA Method 7196A (1992)	0.046	< 0.002	108
Cadmium (Cd)	0.08		FAAS by USEPA Method 7000B (2007)	< 0.08	< 0.08	95
Copper (Cu)	0.009			< 0.009	< 0.009	100
Lead (Pb)	0.05			< 0.05	< 0.05	98
Nickel (Ni)	0.01			0.05	< 0.01	105
Mercury (Hg)	0.0006		CVAAS by USEPA Method 7471A (1994)	< 0.0006	< 0.0006	91
Selenium (Se)	0.02		HVAAS by USEPA Method 7742 (1994)	< 0.02	< 0.02	104
Silver (Ag)	0.01		FAAS by USEPA Method 7000B (2007)	< 0.01	< 0.01	90
Zinc (Zn)	0.02			0.06	< 0.02	100
Total Cynide (CN-)2	0.1		APHA Method 4500-CN.E (2005)	<0.1	< 0.1	89
Flouride (F-)2	2		USEPA Method 340.1 (1978)	<2	< 2	103

（3） The Production of SLS blocks

This project produced approximately 6,000 SLS blocks (size: 21cm x 10.5cm x 6cm) based on the proportion confirmed by the production of test piece and test blocks.

Figure4　Flow of the production of SLS blocks

（4） Performance of SLS blocks

The following tests were conducted by the Indonesian official test laboratory and it was confirmed that there was no problem for the performance of SLS blocks

-TCLP Test
-Strength Test
-Absorption Test
-Reduction Test
-Na2SO4 Resistant

In terms of the construction, as the ‘test construction’ for the purpose of comparing between SLS blocks and the local products, the construction was carried out at the pavement of the entrance in LIPI (Figure 5). Besides, as the ‘exhibit construction’, new pavement of SLS blocks was constructed in the LIPI headquarter (Figure 6).

Figure5 Pavement Construction, Cibinong

Figure6 Pavement Construction, Jakarta

（5） Dissemination Activities of SLS blocks

4 Seminars for dissemination were carried out and SLS blocks were introduced. Stakeholders in Indonesia gained better understanding of this project as well as concrete products including SLS blocks through those seminars. The total of 15 local mass media attended the seminars and 8 of them covered the story.

Seminars and Introduction (16/04/2015), Cibinong

Seminars and Demonstration (21/01/2016), Cibinong

Seminars and Exibition (18/05/2016), Cibinong

Seminars and Demonstration (21/01/2016), Jakarta

（6）Reception of Trainees in Japan

1. Technical Transfer

Technical transfer of the production of concrete was conducted with the English manual of testing molding equipment as teaching material. Besides, operation and maintenance training after installation of the equipment enabled Indonesian locals to learn the knowhow of actual operation. This led to the establishment of the system of production by Indonesian human resources and application of the adjustment of equipment. Moreover, the production manual in Indonesian version was developed by the trainees.



2. Dialogue of Business Development

Dialogue was conducted to promote actual development of skills and business after this project. As a result, it came to an agreement that continuous joint research system with LIPI would continue after this project. The policy was also agreed that the production plan of concrete blocks would be confirmed within this year and the production system would be established by the provision of YHR and transfer of production skills of HIC after the latter half of next year.



（7）Business Development Plan

As an implementation structure of business development, local partner company of HIC called PT. Nanotech Indonesia with the continuous support from LIPI will establish a new company which produces SLS blocks. HIC will provide YHR and the skills of solidification to the company and the production system of SLS blocks will be established by this technical support (Figure 6). After this project, following the plan of Figure 7, business development will be proceeded.

Figure7　Cooperation System

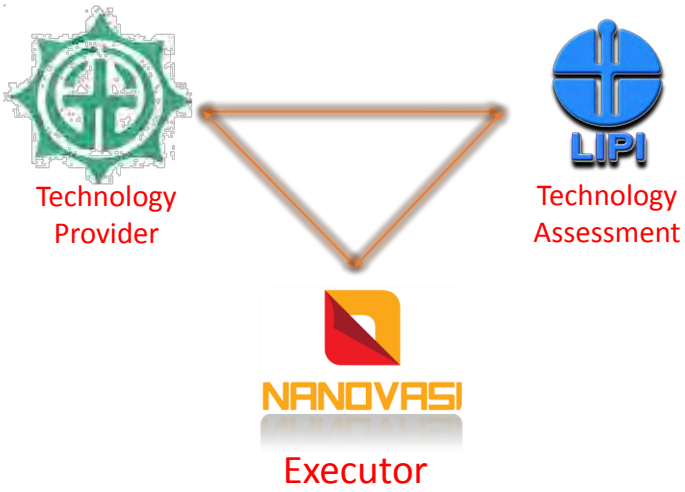
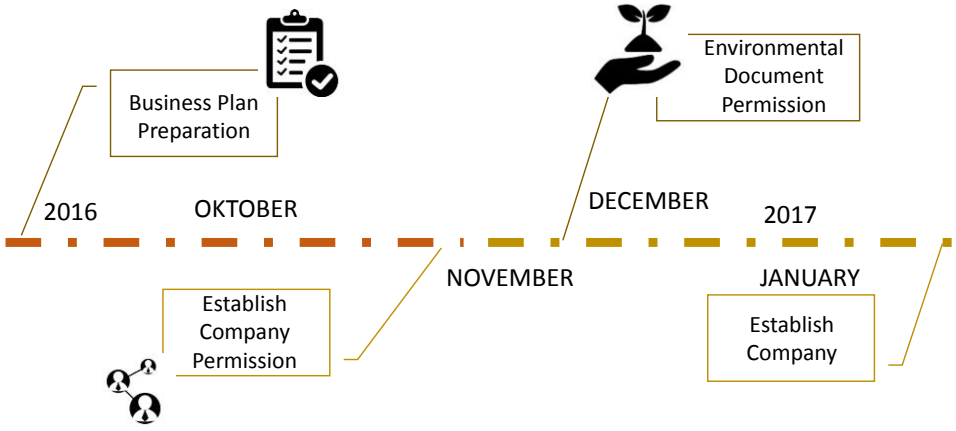


Figure8　Time Line



Appendix 1: Overview of the Project

Indonesia

Verification Survey with the Private Sector for Disseminating Japanese technologies for Eco-Friendly Concrete Products to Development Infrastructure

Hakko Industry Co., Ltd, Japan

Concerned Development Issues in Indonesia

- Reduction of increasing amount of waste
- Improvement of a capacity to deal with natural disasters

Implemented Activities in the Survey

- Production of concrete products made from coal ash
- Verification of SLS block's superiority in Indonesia
- Promotion for understanding of superiority of SLS block and awareness activities for dissemination

Proposed Products/Technologies

- **Solidification Technology of Concrete**
- **SLS(Super Light Stone) Block**

Characteristics

- **Enable to solidify from a variety of waste such as coal ash**
  →Eco-friendly concrete
- **Water permeability**
- **Superior in quality (safety and intensity) and price**

Expected Impact on the Concerned Development Issues in Indonesia

- Reduction of the amount of waste
- Reduction of flood damage
- Inhibition of the occurrence of debris flow
- Inhibition of heat-island phenomenon

Outputs and Outcomes of the Survey

Current Situation

- Implementation of the joint development research for amino acid concrete by business-academia collaboration
- Construction and operation of the Tohoku Factory in Fukushima

Future

- Initiation of consignment production in Indonesia
- Establishment of a company for production and sales in Indonesia and setting up the business revenue model of patent fee and technical assistance

Appendix 2: Survey Schedule achieved