Model Project for Improvement of Water Environment in Asia

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Ministry of the Environment Government of Japan

MOEJ's Strategies to Impro ve Water Environment in Asia

Improve the water environment in developing countries in Asia

- By utilizing Japan's knowledge of the legal systems, human resource development, and technologies through which Japan has gradually improved its water environment.
- By strengthening cooperation and promoting information sharing with
- By disseminating appropriate water treatment and related technologies

Asian countries through WEPA through the Model Project for Improvement of Water Environment in Asia.

Fundamental Support for Water Environment Gover nance

Water Environment Partnership in Asia (WEPA)

- Network of government officials involved in water environment management in 13 Asian countries
- Strengthening water environment governance supporting action programs based on each and operation of legal systems and strengthe

by sharing knowledge and information, and country's request, including improvement ning of wastewater management, etc.

Business Model Building

Model Project for Improvement of Water Environment in Asia

- Public invitation for pilot projects led by private companies. Support for local application and demonstration of Japan's water environment improvement technologies
- Support the formation of various business models in different countries by "showing the effects"

Target Technologies:

Small and medium sized domestic wastewater trea quality monitoring, etc.

Countries where model projects adopted (number Vietnam (14), Indonesia (6), Malaysia (4), India (2), Thailand (1), Laos (1)

tment, Industrial wastewater treatment, Self purification, Water

of cases):

China (2), Philippines (1), Myanmar (1), Solomon Islands (1), Fiji (1),

Improve the water environment







Toward Vitalization of the Business for Improvement of Water Environment in Asia (1)

Projects Overview

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As a result of urbanization due to population growth and industrialization, the environmental problems such as water pollution have become more serious in rapidly growing regions in Asia.

Under the 'Model Project for Improvement of Water Environment in Asia' (hereinafter referred to as 'this project'), Ministry of the Environment of Japan (MOEJ) has encouraged Japanese private companies' overseas expansion of water treatment business and contributed to improvement of water environment in Asian (including Oceania) countries.

This project seeks proposals openly. Selected companies shall conduct a Feasibility Study in the first year and a Pilot Project in the second year, respectively. For establishing autonomous business model, the companies shall verify projects' effect and applicability as a business model in the third year.

(Screening will be conducted before the second year and the third year. However, this does not guarantee that the support will be provided in the period of 3 years.)

Expected Effect

①Commercialization of the FS and the Pilot projects adopted in this project ⁽²⁾Contribution to further development of MOEJ's supporting policy for water treatment business based on findings obtained through project implementation

③Promotion of overseas expansion of Japanese water treatment technologies (Improvement of the water environment in overseas through activities 1)~(3).



Water quality monitoring Industrial wastewater treatment Small and medium sized domestic Self purification wastewater treatment (Johkasouetc.) Sludge recycling

Entrust

review results

Advisory Committee

Examination and evaluation of proposals

Advice on implementing projects

Ministry of the Environment

- Management of the entire project
- Preparation of procedure for public invitation Proposal evaluation and
- Announcement of FS/Pilot Project results, etc.



Budget usage : labor cost, travel cost, research and analysis cost, etc.

Expenses that form assets, such as the purchase or improvement of equipment, are not eligible.

Project Flow Chart

Public invitation for overseas business deployment of water treatment technology

- Industrial wastewater treatment Self purification
- Water quality monitoring, etc.

The first year

After the second year

 Supporting the formation of various business models in Asia and Oceania



Advice from experts

• Small and medium sized domestic wastewater treatment (Johkasou, etc.)

Feasibility Study (FS)

Making a business plan

Pilot Project

•"Show the effects and sell" style

Verification of project effect / business model applicability

Toward Vitalization of the Business for Improvement of Water Environment in Asia (2)

No. Country/City

Achievements

0

This project has adopted and supported 34 businesses for the development of Four adopted projects highlighted in red in the figure are introduced as good

6

2 1 2 3 4

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(7)

diverse business models in various countries from its beginning in 2011 to 2023. practices from Page 8.

> Name of the project [Operator Dissemination Project of AOSD Control System as the Advan

List of Projects Adopted

No.	Country/City	Name of the project [Operator]	Classification	Technology	Fiscal year	
1	India Haryana	Comprehensive upgrading of industrial wastewater treatment systems and promotion of water reuse (Haryana) [Toyo Engineering Corporation,etc.]	Industrial wastewate	MBR (Membrane bioreactor)	2011 : FS	
2	Vietnam Da Nang City	Project on treatment of wastewater from an industrial complex of Da Nang City [KAJIMA CORPORATION,etc.]	Industrial wastewate	Coagulating sedimentation + Membrane Separation(MF,UF)	2011 : FS	
3	Vietnam National Railway Lines	Project for improving water environment by use of bio-toilets [CHODAI CO., LTD.,etc.]	Domestic wastewate	Bio-toilets	2011:FS	
4	Malaysia Penang	Zero emission treatment system for piggery wastewater [Aqua Co., Ltd.,etc.]	Livestock wastewate	Chlorella continuous culture system(MIYABI System)	2011 : FS 2012 : PS	
(5)	Indonesia Jakarta	Improving water quality by Johkasou demonstration test in Jakarta, Indonesia [Kubota corporation,etc.]	Domestic wastewate	Johkasou	2011 : FS 2012 • 2013 : PS	
6	China Shenyang	Water quality improvement and resource recovery in Shenyang, Liaoning Province [Daiki Ataka Engineering Co., Ltd.,etc.]	Phosphorus recovery	PHOSNIX magnesium ammonium phosphate (MAP) crystallization process	2012:FS	
Ø	China Lianyungang City, China	Non-Point Source Pollutants Purification System Lianyungang City, China [CTI Engineering co,etc.]	Non-point source purification system	Contact Oxidation Method using String-like Material Productive biological manipulator	2012 : FS 2013 : PS	
8	Vietnam Hanoi City	Water Environment Improvement Business by Energy-Saving Industrial Organic Wastewater Treatment 【Sekisui Aqua Systems Co., Ltd.,etc.】	Industrial organic wastewater	Biofilm process (Rotating Biological Contactor; RBC)	2012:FS	
9	Solomon Islands Honiara City	Preparatory survey on how to diffuse soil absorption system supportive to environment [Original Engineering Consultants,etc.]	Domestic wastewater	Eco-friendly Toilet, Taisei Soil System (TSS) (soil absorption and evaporation)	2013 : FS 2014 • 2015 : PS	
10	Vietnam Ho Chi Minh City	Promotion of Textile Dyeing Industrial Wastewater Treatment [Kobelco Eco-Solutions Co., Ltd.,etc.]	Dyeing wastewater	Biological wastewater treatment (USDB,MBBR) Oxidation · reduction treatment (heavy metals) Physical/chemical wastewater treatment (Decolor)	2013 : FS 2014 • 2015 : PS	
1	India Suburbs of Mumbai	Establishment of water recycling system for Patalganga industrial park in India [FUJI ELECTRIC CO., LTD., etc.]	Recycled water	Water recycling system	2014 : FS	
(12)	Vietnam Da Nang City	Project for improving the water quality from the wastewater treatment facility and its operation in fishery processing factories [The General Environmental Technos, etc.]	Fishery wastewater	Microbial immobilization carriers PVA gel	2014 : FS 2015 • 2016 : PS	
(13)	Malaysia Selangor	Johkasou introduction project for domestic wastewater treatment improvement in Malaysia [Japan Education Center of Environmental Sanitation (JECES), etc.]	Domenstic wastewater	Johkasou	2014 : FS 2015 • 2016 : PS	
(14)	Vietnam Ho Chi Minh City	Proposal for septage treatment project in Vietnam [Hitachi Zosen Corporation,etc.]	Domestic wastewater	Methane fermentation treatment with sludge	2015 : FS	



(1)

	Classification	Technology	Fiscal year
ed and	Organic wastewater	AOSD Bioreactor control systems	2015 : FS 2016 • 2017 : PS
lls	Dyeing wastewater	Continuous water quality monitoring	2015 : FS 2016 • 2017 : PS
ads	Direct purification of river	Hi-Beads(Granulated coal ash)	2016 : FS
stems in	Livestock wastewater	Hybrid subsurface flow constructed wetland system	2016 : FS 2017 • 2018 : PS
park in	Dyeing wastewater	Aerator	2016 : FS 2017 • 2018 : PS
cation of	Industrial wastewater	Highly concentrated waste liquid treatment	2017 : FS 2018 • 2019 : PS
ditional stry,etc.]	Domestic wastewater	Wastewater treatment unit utilizing existing septic tank	2017 : FS 2018 • 2019 : PS
bination d.,etc.]	Textile industry wastewater Anaerobic baffled reactor+ down-flow hanging spongesystem		2018 : FS 2019 : PS
areas in]	Domestic wastewater	Portable toilet system	2018 : FS 2019 • 2020 : PS
esource bic Filter	Domestic wastewater	Anaerobic aerobic filter method (A2F)	2018 : FS 2019 • 2020 : PS
arrier to	Fishery and food industry wastewater	Multiple compartment biological treatment with fiber carrier	2019 : FS
d an IoT r in Bali,	Domestic wastewater	Aeration system and IoT monitoring device	2019 : FS 2020 • 2021 : PS
nt in the	Direct purification of lagoon waters	DHS(Downflow Hanging Sponge) method	2019 : FS 2020 • 2021 : PS
vsia	Palm oil mill effluent	Treatment system using foamed glass (Porous Alpha)as a microbial medium	2019 : FS
oment in Industrial wastewater		HARNET water treatment equipment (filter bed type) that places the highest priority on the living environment of microorganisms by contact oxidation method	2020 : FS
ohkasou .]	Domestic wastewater	Japanese advanced johkasou system (high-quality wastewater treatment)	2020 : FS 2022 • 2023 : PS
ories	Textile dyeing wastewater	Automatic regeneration activated carbon filtration system	2021 : FS 2022 : PS
stewater nology in	Wastewater in metal processing/metal treatment factories treatment in metal processing/metal treatment factories	ewater in metal cessing/metal tment factories timent in metal cessing/metal tment factories	
dustry in	Dyeing wastewater	Membrane treatment technology for the recycling of industrial wastewater	2022 : FS 2023 : PS
roducing	Sewage sludge treatment	Organic waste volume reduction system using high temperature aerobic fermentation technology	2023 : FS

FS: Feasibility Study, PS: Pilot Study

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Preparatory Survey on How to Diffuse Soil Absorption System That is Environmentally Conscious in Solomon Islands

Pay-for-use Toilet Business for People Suffering from Pollution

In Honiara city, Solomon Islands, water pollution has become a serious issue due to discharging untreated-wastewater. The survey verified the water environment improvement effect and the secondary effect of this water treatment technology in the Feasibility Study. In the Pilot Project, a demonstration equipment was set to run an actual operation, at the same time, guidance on toll collection method as well as awareness raising activities were provided with local people to establish a business which radicates use of toilet in the area.

Situation

In Solomon Islands where outside excretion is inveterate among inhabitants, septic tanks prevailing in in Honiara city have been insufficiently managed. As a result, night soil is discharged without treatment. The environment pollution by the untreated wastewater has been causing various issues.

Worsening Damage to Health and Tourism

Water-borne infections such as trachoma and diarrhea affect health below the age of 5 in the country, and in extreme cases it will result in death. Pollution or smell caused by outside excretion and untreated wastewater also affect the fishery supporting lives of people in the islands and the tourism as a resort site represented by beautiful beaches.



Background

Resort

without

Facility

Sanitation

Beaches popular for tourists



Marine pollution in urban areas



River pollution in the city



Closed public toilet

Establishment of Implementation System in Japan / the Local **Business Model**





FY

13



Untreated wastewater polluted the environment Sentic Tank

Companies

'15

14

Eco-friendly Toilet: Taisei Soil System (TSS) is a wastewater treatment system which uses Japanese traditional technologies "tank for holding excreta" and "a field" for treatment of night soil. TSS adopts septic tank as pre-treatment equipment, and after that uses special materials "Tafgard" to treat wastewater by the action of soil absorption and evaporation. The quality of treated water by TSS is the same as the one by aeration type Johkasou. TSS is designed to have simple structures and generate little sludge after treatment, which makes maintenance easier.

Contents of Implementation To be Called as **"The Cleanest** Toilet" in Solomon



In the Pilot Project, a demonstration system was set up at a school and public toilet. Usage of public toilet was charged. Fees collected from users is used to contribute job creation by hiring people for cleaning or toll collection. Also, a business model which holds promise for increasing the number of uses and improving the quality of living of local people by providing a shower and an attached retail shop (Kiosk) was studied.

Increase in the Number of the User

Public toilets installed as demonstration system are close to the event square and the number of users are increasing year by year. At the beginning of the installation, only about 50 people used the toilet per day. However, three years later, at the most, more than 300 people used it in a day. It has been popular in SNS and local media and the reputation is spreading. A toilet that make people want to use even paying the usage fee about 0.5 USD was realized.

Current Situation Overseas Pilot Project in India has Commenced

- •In Solomon islands, even after the implementation period, the operation of a pay-for-use toilet installing demonstration system is being continued mainly by the local company "Ocean Wave". A business model that adopts pay-for-use system to the other existing public toilets and realizes stable revenue by toll collection and installing TSS gradually is now under consideration.
- Taisei Kogyo and Original Engineering Consultants applied to JICA's project "Verification Survey with the Private Sector for Disseminating Japanese Technologies" and "Tafgard Technology for Environmentally Friendly Toilets" in India" was adopted in FY2017. In FY2018, verification survey and pilot project are being implemented.

Original Engineering Consultants Co., Ltd., Taisei Kougyou Co., Ltd. Japan Environment Sanitation Center, Saitama Prefecture, Japan-Solomon Friendship Association



Setting Demonstration System in Pilot Project



Proposal of Technology to Boost the Economic Growth

In Vietnam, the textile industry is a driving force of the economic development, while it is positioned as an industry with large environmental load because dyeing wastewater treatment is not appropriately implemented. Technology investigation was implemented to find a solution to realize environmentally-friendly operation.

Water Pollution Caused by Dyeing Wastewater

Background

Economic Growth **Together with** Reducing **Environmental** Load

The textile industry which drives Vietnamese economic growth is expected to develop even further. On the other hand, the industry is listed as one of the specified 17 industries which impose heavy load on the environment. Therefore, the environmental authorities are promoting relocation of the factories from urban areas and strengthening the guidance. In addition, it is difficult to gain permission to construct new factories.

Challenge of Appropriate Technology Introduction and Promotion There are 295 industrial parks in Vietnam (as of 2014), however less than half of them have suitable wastewater treatment facility. There are also many cases where provided facilities are not utilized appropriately.

Discharging untreated dveing wastewater to waterway (Ho Chi Minh City



EPC Business of Wastewater Treatment Facilities Business Model



Introduced Technology

FY 13

Efforts on **Removal of COD** and Chrominance **Materials**

Contents of

A Treatment

Envisaging

Operational

Environment

Method

Actual

Implementation

Wastewater from dyeing factories contains high COD and chromaticity materials, therefore it is necessary to remove mainly those two items throughly as well as economically in order to conform to wastewater standards. Biological wastewater treatment methods, "UASB system" which is "Anaerobic treatment" and "MBBR method" in which carrier is put into reaction tank were suggested. As Physical/Chemical wastewater treatment, following treatment methods were proposed: "Coagulation-Sedimentation" which combines coagulant and chromaticity remover etc., "Oxidation" using Ozone, NaClO etc. and "Filtration/Absorption" using filtration and activated charcoal.



Consideration on Optimal Chemical Injection / Its Process

Consideration was given to an optimal amount of the chemical injection / process which realizes the balance between the treatment effect and economy by conducting a treatment test using container type demonstration experiment equipment. Reusability of reused water in factories was also examined by improving the quality of the treatment water to meet the strict standards for discharged water quality in Vietnam.

Evaluation of Treatment Performance with Dyeing Wastewater Consisting of Different Dyeing Items

In actual operation, different coloring agents (Disperse system, Reaction system, Acid system and Vat system etc.) are used therefore the properties and difficulty of treatment of those wastewaters also differ. Several coloring agents may be used depending on the products. In addition, the fluctuations in wastewater properties also vary largely depending on the time of day. Therefore, challenges and the solution for realizing stable treatment under this actual operational environment were proposed.

Current Situation Overseas Orders from Apparel Makers

- ●In 2015, the data obtained in those studies was utilized for receiving an order for installing wastewater treatment facility in a factory from a Japanese company that has a presence in Vietnam.
- In 2017, the order for the wastewater treatment facility for clothing factory (Vinh Phuc province Ba Thien II Industrial Park) from a factory affiliated with TAL apparel company in Hong Kong was received. It owed much to the fact that the factory highly appreciated the efforts in accumulating various data on the quality of wastewater generated in fiber dyeing and the method of treatment, striving for the most appropriate proposal according to any water quality.





Container type demonstration experiment machine

Johkasou Introduction Project for Domestic Wastewater **Treatment Improvement in Malaysia**

'15 14 16

Spreading Japanese Johkasou

Water quality deterioration in public waters was a problem in the areas where wastewater treatment system was not prevailed. Therefore, technology of Johkasou which had been proven as a decentralized system was introduced and spreaded. Then, technology standards for sustainable operation and specialized human resource development program were proposed and implemented.

Background

Lack of Domestic Wastewater Treatment **Systems**

Lack of Domestic Wastewater Treatment Systems

In Malaysia, there are 4,400 Community Septic Tanks (CST) for domestic wastewater treatment. However, the most of them are not functioning due to deterioration of facilities, structural defects and lack of maintenance. This has led to the deterioration of water quality in public waters.

Improvement of Wastewater Treatment by Introducing Johkasou Having received a request of setting a model of Johkasou from the government organization

National Water Services Commission (SPAN) which holds jurisdiction over hygiene control, the contribution was made for the improvement of the hygiene and water environment around the area by updating CST. In addition, technical training for maintenance of Johkasou etc. was carried out. Those activities contributed to the improvement of the Johkasou business environment.



Left: Discharged water from CST **Right: Deteriorated CST**

Business Model Design, Production and Operation and Management of Wastewater Treatment Systems



Introduced Technology Japanese Johkasou Technology

Johkasou are compatible for variety of scales from individual household to housing complex and designed for treating all wastewaters including black water discharged from houses. The treatment principal is that the contaminants contained in wastewater are broken down biochemically by the catabolism of microorganisms such as bacteria and metazoan organisms. Other functions in Johkasou include solid liquid separation, sludge storage and disinfection, however appropriate maintenance such as regular removal of sludge is necessary to keep originally expected performance.

In addition to the treatment performance standard, construction by certified persons and annual inspection are stipulated by law and are strictly operated.

Companies

	Inflow	Outflow	Removal rate		
BOD	200mg/L	20mg/L	90%		
T-N	45mg/L	20mg/L	55.6%		
Treatment performance of Johkasou					

Contents of Implementation

Acquiring Certification by SPAN and Human Resource Development Plan

It was proven that the Japanese Johkasou achieved the required treatment performance under the conditions of wastewater inflow in Malaysia. The table below shows the performance when the system treated local wastewater.



Johkasou in Pilot Project

Certification by SPAN and Proposal of Human Resource Development Plan

For disseminating Johkasou, it is necessary to gain technical certification by SPAN. In accordance with the provisions of Malaysia, those studies were implemented to obtain necessary permission. In addition, training program was conducted both locally and in Japan because people with specialized skill were essential for stable operation.

Current Situation Overseas Aims for Ripple Effect from Malaysia

The Malaysian market is promising. Also, spreading in Malaysia will make for a good model for the other Southeast Asian countries. Therefore, firstly, it is hoped to build success model of environmental business in Malaysia and develop fields to the other Southeast Asian countries by utilizing the experiences as a steppingstone.



Test of Treatment Performance Under the Local Environment

	Table Johkasou Effluent quality					
-200		BOD	TSS	NH₄-N		
Rat of	The mean value	9.2	8	11.2		
and T	The maximum Value	13	14	16		
	The minimum value	5	2	1		
1000						

Project for Efficient Management of Domestic Wastewater by Applying Liquid Film Aeration System and IoT Monitoring Sensor in Bali. Indonesia



Dissemination of Japanese advanced management technology for septic tanks

In Bali, Indonesia, septic tanks have been installed for decentralized wastewater treatment. However, due to a lack of appropriate management, wastewater was discharged nearly untreated, resulting in the deterioration of water quality in public water bodies, including coastal areas. Therefore, we introduced our advanced septic tank management technology, which uses a liquid film aeration system and IoT sensors at a low cost to provide stable treatment and improve the quality of treated water.

Background

Lack of Septic Tank Management Technology And Human Resources

 Water guality deterioration due to lack of septic tank management technology In Bali, Indonesia, the sewerage coverage rate is low and wastewater purification relies heavily on septic tanks. However, maintenance and inspections to maintain the capacity of septic tanks are rarely conducted. The sewage discharged from inadequately functioning septic tanks is causing significant deterioration of the water environment.

Lack of human resources with management skills and knowledge The lack of appropriate septic tank management technology and human resources with sufficient knowledge has caused the facility management to struggle to understand how to improve the situation, even if they are aware of the problem. The challenge is to develop human resources that have the knowledge to provide efficient management technology and adequate advice.



Sludge outflow from sedimentation tank

Insufficient adjustment of flow rate



Damaged Equipment

Introduction and Operation of Advanced Septic Tank Management Technology and Human Resource Development Through Industry-government-academia Collaboration **Business Model**



Introduced Technology

Low-cost Japanese Management Technology

Contents of

Implementation

Verifying Local

Applicability

Of Introduced

Technologies And Potential

Development.

For Human Resource

The liquid film aeration system is a technology that enables the improvement of DO levels, which are the cause of low treatment capacity on site, by simply adding a special diffuser. In addition, due to the low density of managed facilities in Bali and the high cost of travel for inspections, IoT sensors were installed in septic tanks at each facility so that the

status of all facilities could be continuously monitored at the facility management office. This allows us to send out an alert when a sudden deterioration in septic tank water quality is detected, so that we can go to the site and handle the situation.

IoT transmitter

Verification of newly introduced technologies

We installed a liquid film aeration system in a hotel's septic tank and conducted a demonstration test, which confirmed that the system improved DO values and contributed to improved water quality. We have also confirmed that these values could be constantly monitored at the local office using IoT sensors to respond immediately to any changes in water quality.

Before: DO 1.7mg/L 4 days later Feb. 12, 2020 DO increased to 3.1mg/l



Set of 5-unit (left) and 3-unit (right)



Installing IoT sensor IoT Sensor Devices Conducted seminars to improve the importance of management technology and the knowledge of management personnel Based on the results of the above verification, seminars were held to inform local stakeholders about the theory and practical methods of septic tank management technology and the effectiveness of the introduced technology.

Current Situation Overseas

- Since septic tank management technology is also in demand in urban areas in Indonesia, we are planning to expand our business by taking advantage of our integrated management system.
- In addition to this project, we have also received orders from JICA in 2016 for the "Feasibility Survey for Improving Water Environment in Bali with Holistic Maintenance System for Septic Tank of Wastewater Treatment"

Earth Creative Co., Ltd. Yamaguchi University, IC Net Limited Kagikosu LLC



Liquid film aeration system diffuser





Inside of IoT transmitter



IoT pH sensor, etc

February 12, 2020 laced with 5 consecutive liquid membrane Feb. 12, 2020 DO 3.1mg/L 7 days later Feb. 19, 2020 DO increased to 4.4mg



The effectiveness of the liquid film aeration system was confirmed

AS-25

Changing to a 5-unit liquid film aeration system





IoT data interface

Considering Expansion from Bali to Other Provinces in Indonesia