Case Study of Co-benefits Project in Fish Industry

Overview of survey on co-benefits type wastewater measures in fishery industry in Indonesia

(1) Objective of the survey

Reduce pollution load to public waters by introducing excellent wastewater treatment technology of Japanese companies in order to promote measures for wastewater treatment in Indonesian fish processing industry. At the same time, contribute to the prevention of global warming by preventing the generation of greenhouse gas from wastewater that is drained untreated and by introducing a treatment method which consumes less energy than the usual method. Transmit the technology by conducting capacity-building in the survey process as well.

(2) Contents of survey

1) 1st phase (FY2011-FY2014)

- FY2011: Identification of the state of fish processing industry and survey related to legal regulations in Indonesia
- FY2012: Selection of factories for demonstration, survey on co-benefits type wastewater treatment technologies of Japanese companies and selection of technology to introduce
- FY2013: Installment and test operation of demonstration facilities
- FY2014: Operation of demonstration facilities, analysis of measurement result and assessment of effect caused by introduction

2) 2nd phase (from FY2015)

To achieve more co-benefits effects, improve the wastewater treatment method introduced in the 1st phase (introduction of anaerobic treatment) and conduct demonstrations of wastewater treatment at multiple fish processing factories.

1. State of wastewater management in fish processing industry in Indonesia

(1) State of legal regulations

● For wastewater regulations, each type of fish processing industry has a different standard. Strict limit is also set for wastewater quality, as well as for load amount.

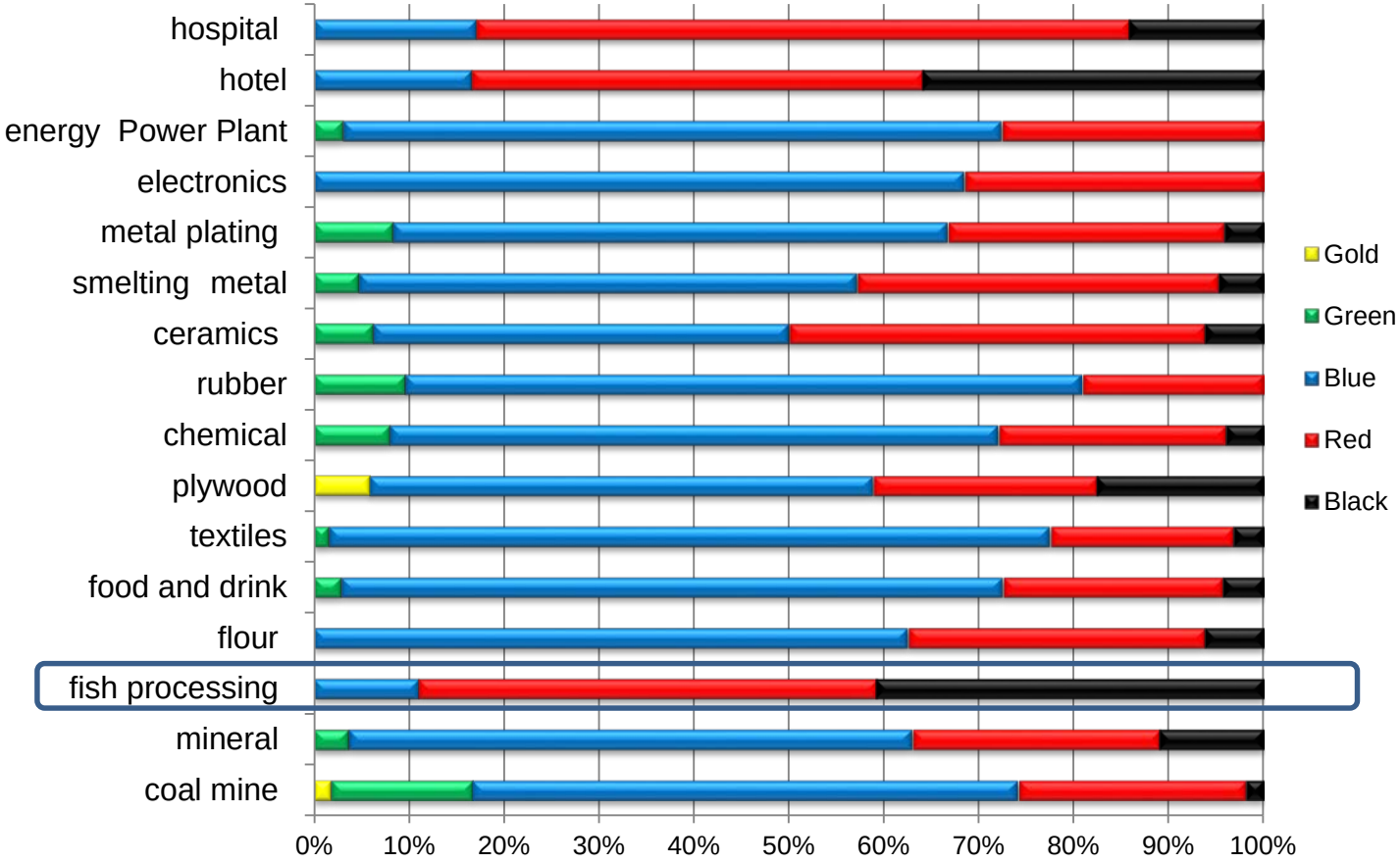
	Indonesia	Japan	Comparison
Wastewater standard items	pH, SS BOD, COD Oil-Fat Sulfide, ammonia, chloride (wastewater standard items in fish processing industry)	pH, SS BOD, COD Normal hexane extracts (mineral oils, animal/plant oil) Phenol, copper, zinc, iron Manganese, chromium Number of colitis germ legions Nitrogen, phosphorus	Indonesia decides the standard items considering the industry types. Japan includes number of colitis germ legions.
Wastewater standard limit	mg/L<frozen> <canned><fishmeal> BOD 100 75 100 COD 200 150 300 SS 100 100 100	mg/L<fixed wastewater standard> BOD 160 (av. 120/day) COD 160 (av. 120/day) SS 200 (av. 150/day)	Indonesia sets a strict standard for some industry types. In Japan, it applies to factories of more than 50m^3/day.
Water quality standard , load amount	Kg/t <frozen><canned><fishmeal> Quantity 10 15 12 BOD 1 1.125 1.2 COD 2 2.25 3.6 SS 1 1.5 1.2	Load amount is not targeted by regulations in general public waters, but in closed waters (bays, lakes) as regulation of total amount.	Load amount is not regulated for general rivers in Japan. The standard for load amount is fixed in Indonesia.

Note: Oxidizing agent in COD uses chromium method in Indonesia and manganese method in Japan, thus incomparable. In Japan, BOD applies to rivers and COD to lakes and seas.

1. State of wastewater management in fish processing industry in Indonesia

(2) State of environmental management

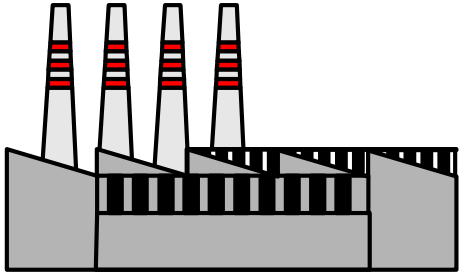
● Environmental management of fish processing industry is evaluated as the worst level in PROPER System, promoted by Ministry of Environment. Black and red evaluations occupy 90% in FY2012 evaluation result (blue indicates the level that satisfies the effluent standard, and red and black indicate the low management level).



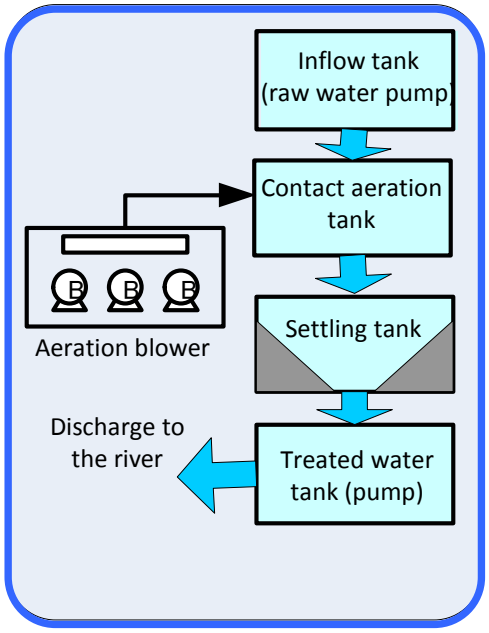
1. State of wastewater management in fish processing industry in Indonesia

(2) Measures to improve wastewater management

● Necessary to introduce legal systems and measures, such as technical guidance, in order to promote installment of appropriate wastewater treatment facilities and operate it properly.



Factory



No wastewater treatment facility

Effluent standard is not met

Even if the fish processing factory has wastewater treatment facilities, the treatment is not efficient (not biological but physicochemical treatment)

Introduction of wastewater treatment facilities by laws and system (PROPER) etc.

Technical capacity to select a wastewater treatment method according to the wastewater quality and operate properly

Improvement of compliance and technical capacity using the system of qualification such as pollution control manager

Development, research, education of wastewater treatment technology by universities and research institutes

Offer of management support tools through training, guidelines, etc.

2. Selection of demonstration site

(1) Sites proposed for demonstration

● Conducted on-site survey for 3 sites (as below) proposed by Ministry of Environment in Indonesia

	Muara Angke	Bitung	Jembrana
Province, area	Muara Angke, Special Capital Province of Jakarta	Bitung, North Sulawesi Province	Jembrana Department, Bali Province
Fish catch (t)	About 20,000	About 850,000	About 25,000
Population	10,000	178,000	37,800

2. Selection of areas for demonstration

(2) Assessment of survey-targeted areas

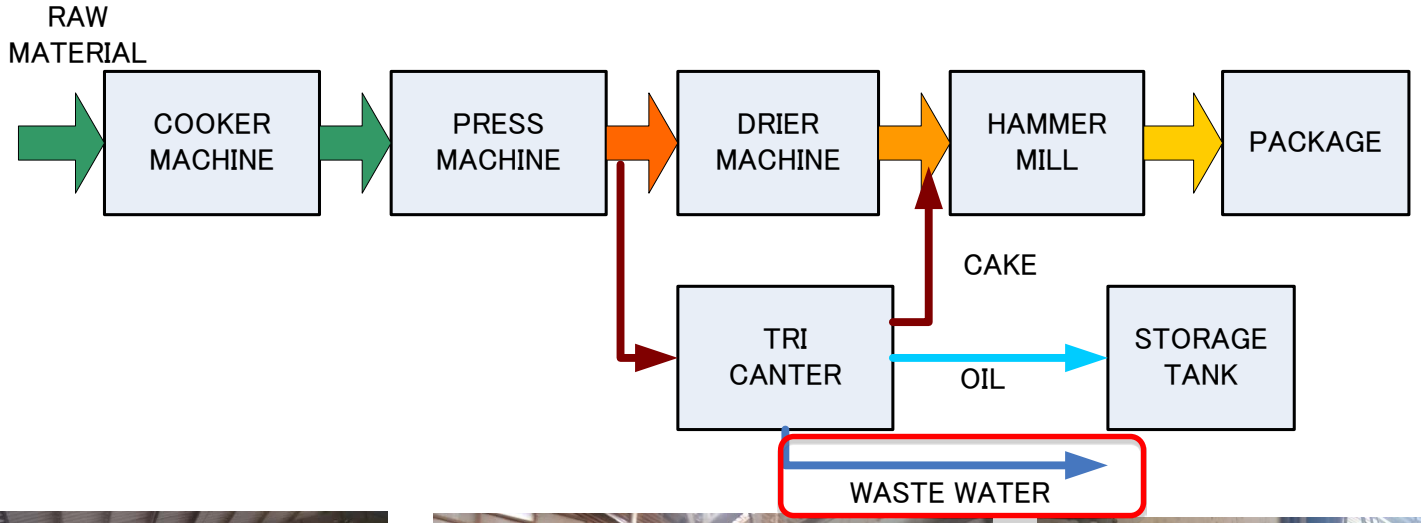
● The demonstration site, a fish processing factory in Jembrana, Bali Province, was selected according to the below assessment indicators.

	Muara Angke	Bitung	Jembrana
Target factory	Group of small factories that drain to the 1st pond	PT. Sari Malalugis (or PT. Sari Cakalan)	PT. Hosana Buana Tunggal
Facility installment site	Next to wastewater pumps (unable to regulate people's access)	Inside the factory (possible to regulate access at the factory entrance)	Inside the factory (possible to regulate access at the factory entrance)
Space available for installment	About 150m^2, no height limitation	About 200m^2, no height limitation	About 150m^2, no height limitation
Emplacement route	Possible to emplace through peripheral road (6m wide)	Possible to emplace, maximum 5m high due to the gate structure	Possible to emplace
Intake point	80m conveyance from intake point to installment site	Existing settling tank (intake basin available)	Existing settling tank
Discharge point	Inside the pond	Possible to discharge from side ditch to sea	Drainage channel
Ground condition	Not good, the area with subsided ground	Weak ground (raft foundation due to low load)	Weak ground (raft foundation due to low load)
Utility	Electricity: unable to use the power source at pumping site, need for in-house generation for blackout Water: buy from water supply truck	Electricity: need for new power incoming facility and in-house generation Water: possible to secure tap water	Electricity: possible to use the existing facilities Water: possible to use the ground water
Wastewater	About 250m^3/day	About 600m^3/day	About 15-20 m^3/day
Safety	Safety facilities such as fences are necessary due to fear of theft	No need for robbery prevention facilities as it is installed inside the factory	No need for robbery prevention facilities as it is installed inside the factory
Related projects	Impossible to install, as the redevelopment of Muara Angke will start earlier	No related project	No related project
Willingness to cooperate	Jakarta UPT is unwilling	PT. Malalugis factory manager and Bitung local government are both cooperative	PT. HOSANA factory manager and Jembrana local government are both cooperative
Installment possibility	・Impossible to install, as the redevelopment will start earlier ・The area was submerged by flood in Jakarta on 17 Jan. 2013, and installment of experiment facility is impossible	・No need for large intake and conveyance facilities. Installment conditions are thus advantageous ・The factory manager is willing to cooperate for demonstration but does not provide sufficient detailed data	・No need for large intake and conveyance facilities. Installment conditions are thus advantageous ・The factory manager is willing to cooperate for demonstration and has good attitude and understanding of environmental management
Assessment result	Not good	○	◎ Priority

2. Selection of demonstration site and factory

(3) Production process of selected fish processing factories

● Density of wastewater of organic substances is very high due to the process of smothering ingredients. Oil is collected by centrifuge, but drained without being removed completely.



① Cooker machine

② Drier

③ Tricanter

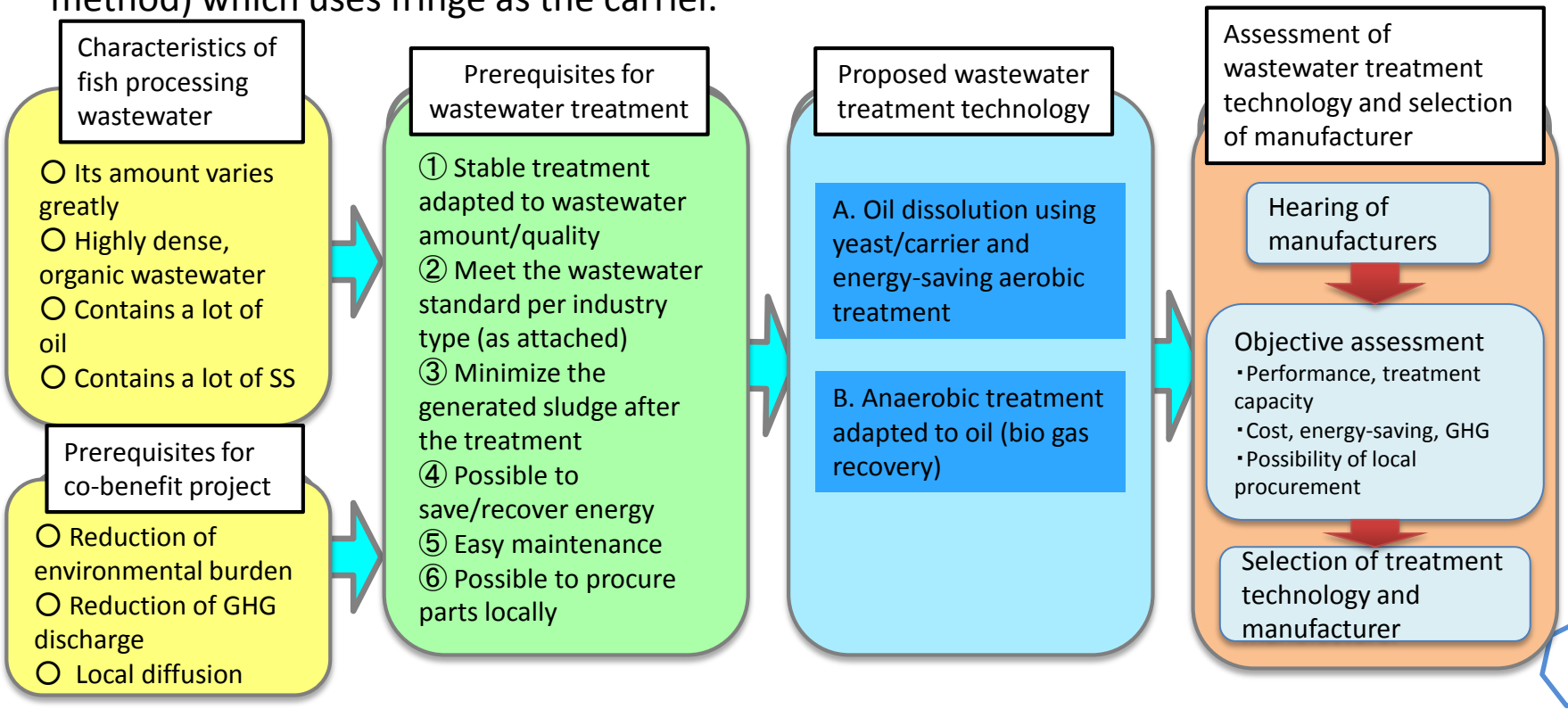
3. Wastewater treatment technology used in demonstration

(1) Selection process of wastewater treatment technology

● We defined prerequisites for wastewater treatment based on characteristics of wastewater from fish processing factories, and for co-benefits project. We then selected wastewater treatment technologies for proposal, and made the final selection through hearing of manufacturers.

● As proposal, A) oil dissolution using yeast/carrier and energy-saving aerobic treatment and B) anaerobic treatment were selected.

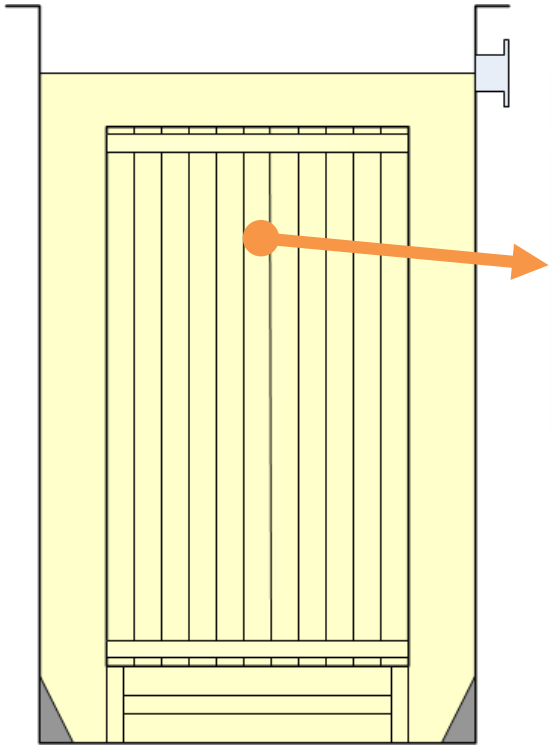
● As the result of assessment, we selected A) oil dissolution using yeast/carrier and energy-saving aerobic treatment, and adopted swinging contact aeration method (SW method) which uses fringe as the carrier.



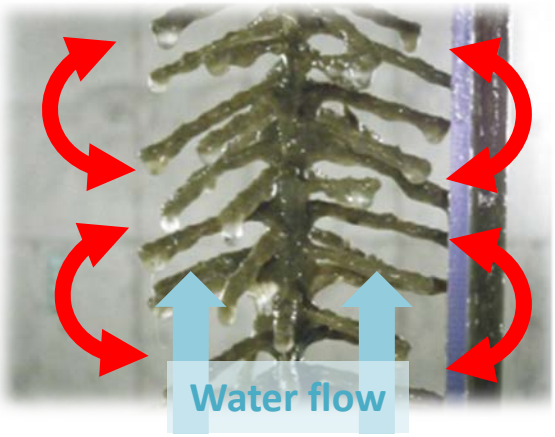
3. Wastewater treatment technology used in demonstration

(1) Characteristics of Swim Bed method - 2

● Swim Bed method can make relatively big microbes stuck on the fringe installed in the tank and stabilize in the reaction tank. It can thus keep SRT(Sludge Retention Time) for a long time and dissolve oil.



Swim Bed Tank



Swim Bed (fringe)

Swim Bed in the tank

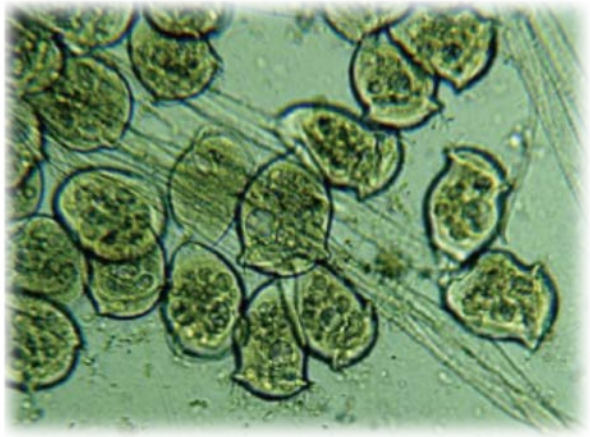
Fringe swims up and down using the water flow and microbes continuously separate and stick. It keeps the sludge in the tank in high density, and microbes which are suitable for oil dissolution increase

● **Thanks to Swim bed (fringe) on which microbes stick, there is no problem of clogging nor simultaneous separation unlike the ordinary fixed floor.**

3. Wastewater treatment technology used in demonstration

(2) Energy-saving characteristics of Swim Bed method

Possible to keep microbes stuck on the Swim Bed (fringe) installed in the tank and maintain the sludge density (MLSS) high in the tank with returned sludge



▼

Diverse biota (bacteria, rotifers, oligochaetes and other metazoans, etc.) can exist in the aeration tank
<u>* Microbes which dissolve oil increase and are maintained</u>

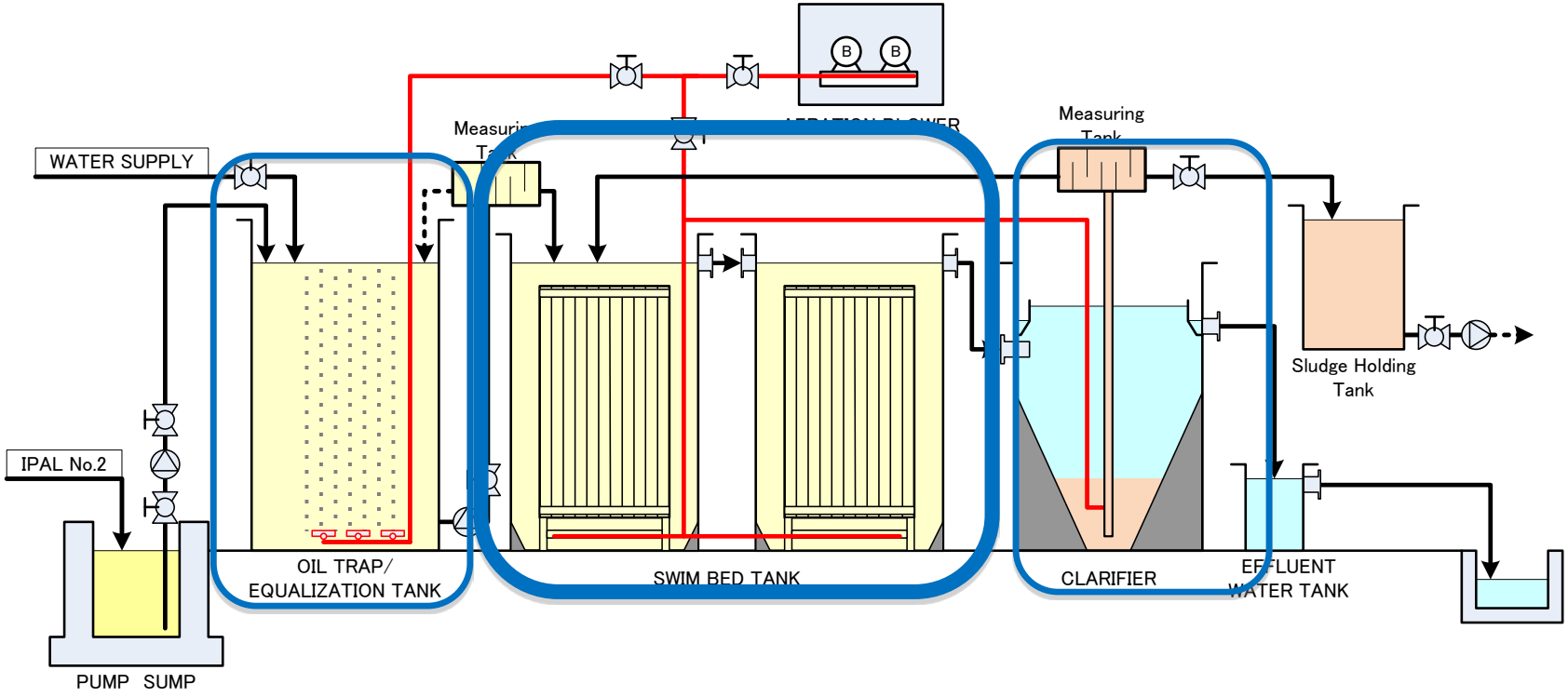
○ Stable, high-loading treatment is possible according to the water temperature and change in water quality
○ Less sludge is generated as the food chain in the tank becomes longer and sludge destructs itself

▼

Possible to save energy as pre-treatment, such as floatation equipment (DAF) required when applying activated sludge method to fish processing wastewater, is unnecessary and sludge treatment amount is reduced thanks to the high-loading treatment

3. Wastewater treatment technology used in demonstration

(3) Treatment flow of demonstration plant



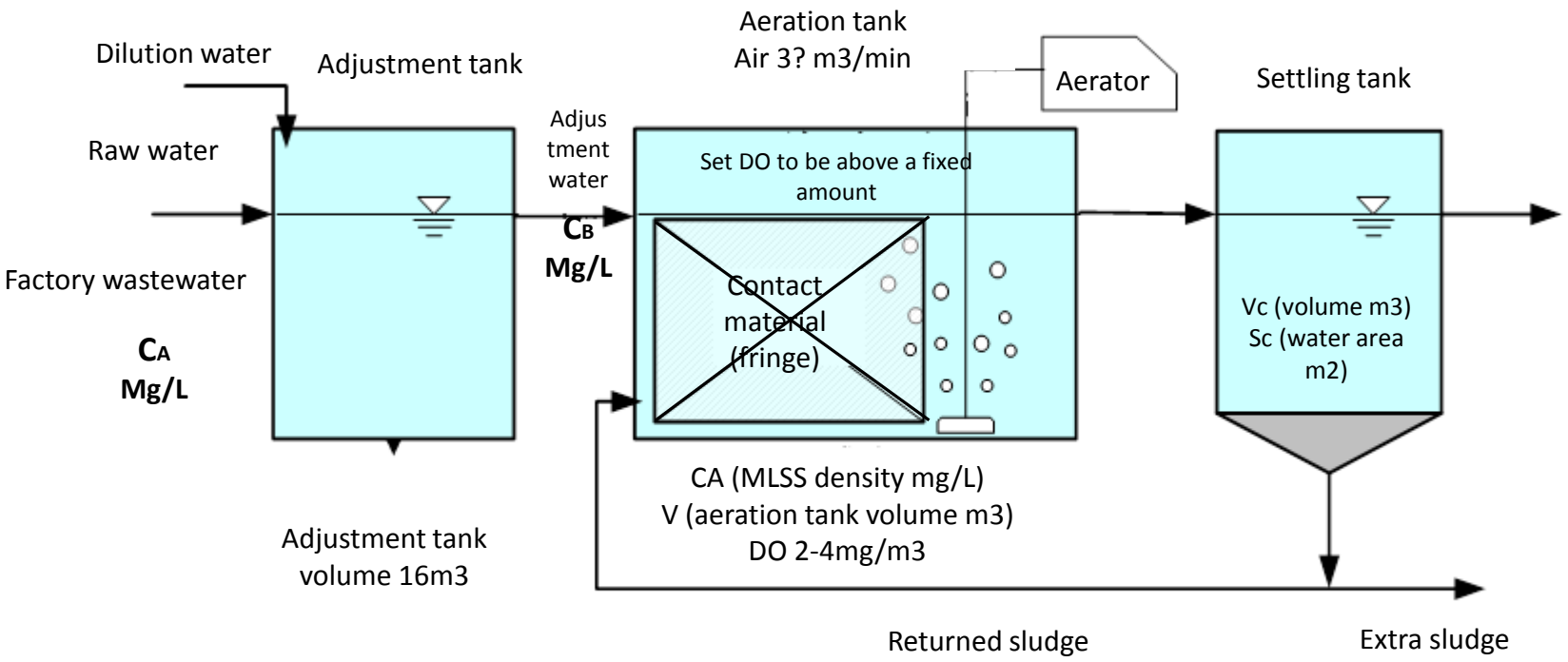
Adjustment tank	1 tank	15m^3, 2.25 m (ϕ) × 4.3 m (H), pump 0.5m^3/min × @10m, 0.75kW
Reaction tank (SW)	2 tanks	16m^3, 1.2 m (W) × 1.8 m (L) × 4.08 m(H), retention time 8hr, BOD volume load 3kg-BOD/m^3/day
Settling tank	1 tank	6m^3, 2.25 m (ϕ) × 4.08 m (H), settling speed10m^3/m^2/day, pump 5m^3/min × @5m, 0.75kW
Blower	2 blowers	3.6 m^3/min, 2.0 m^3/min × 40 kPa, 1kg-O_2/kg-COD, 3.7kW Invertor control

4. Result of demonstration

(1) Operation method of demonstration

- Inverter control of aeration amount to keep the dissolved oxygen (DO) in reaction tank above a fixed level (more than 2mg/L)
- Conduct the operation method in 3 cases as below to confirm the energy-saving effects

① Case1: operation at designed value, ② Case2: 80% aeration amount,
③ Case3: intermittent aeration operation



4. Result of demonstration

(2) Items monitored in demonstration

● Water temperature, pH, COD, SS, NH_4-N, MLSS, SV30 were measured daily by simplified measurement method (● on the list), and BOD once a week by laboratory analysis (◎ on the list)

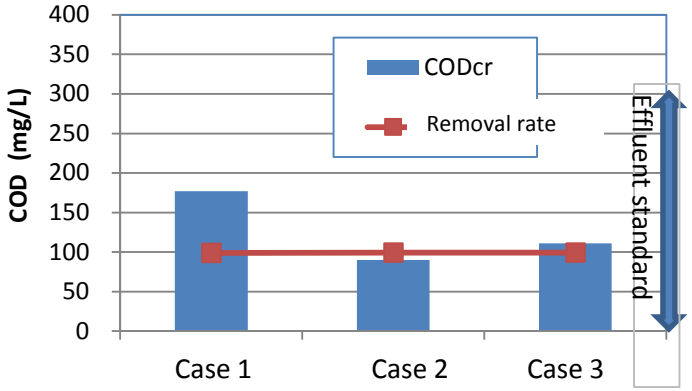
Water quality item	Influent water	Aeration tank		Wastewater	Measurement equipment (simplified measurement)
		①	②		
Water temperature	◎	◎	◎	◎	Thermometer
pH	◎●	◎	◎	◎●	pH meter
DO		◎	◎		DO meter
CODcr	◎●			◎●	HACH (colorimeter)
BOD	●			●	
SS	◎●			◎●	SS meter
NH_4-N	◎●			◎●	Pack test
Cl	●			●	
Oil	●			●	
Sulfide	●			●	
Transparency				◎	1L cylinder
MLSS		◎	◎		MLSS meter
SV30		◎	◎		1L cylinder

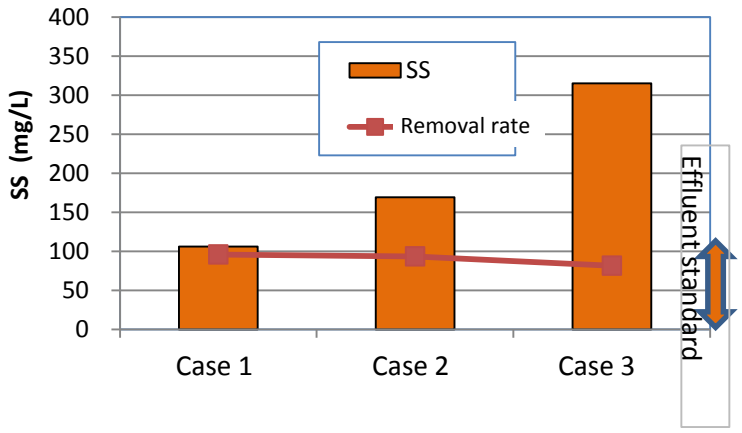
4. Result of demonstration

(3) Removal rate per quality of treated water and wastewater treatment

- The removal rate of CODcr was over 98% for every case, and the quality of treated water met the wastewater standard.
- The removal rate of SS was high in Case 1, but decreased in Case 2 and 3.

		Case 1	Case 2	Case 3
CODcr	Before treatment	13,970	13,564	13,496
	After treatment	177	90	111
	Removal rate	98.7	99.3	99.2
SS	Before treatment	2,673	2,673	2,345
	After treatment	106	169	315
	Removal rate	95.6	93.5	81.3

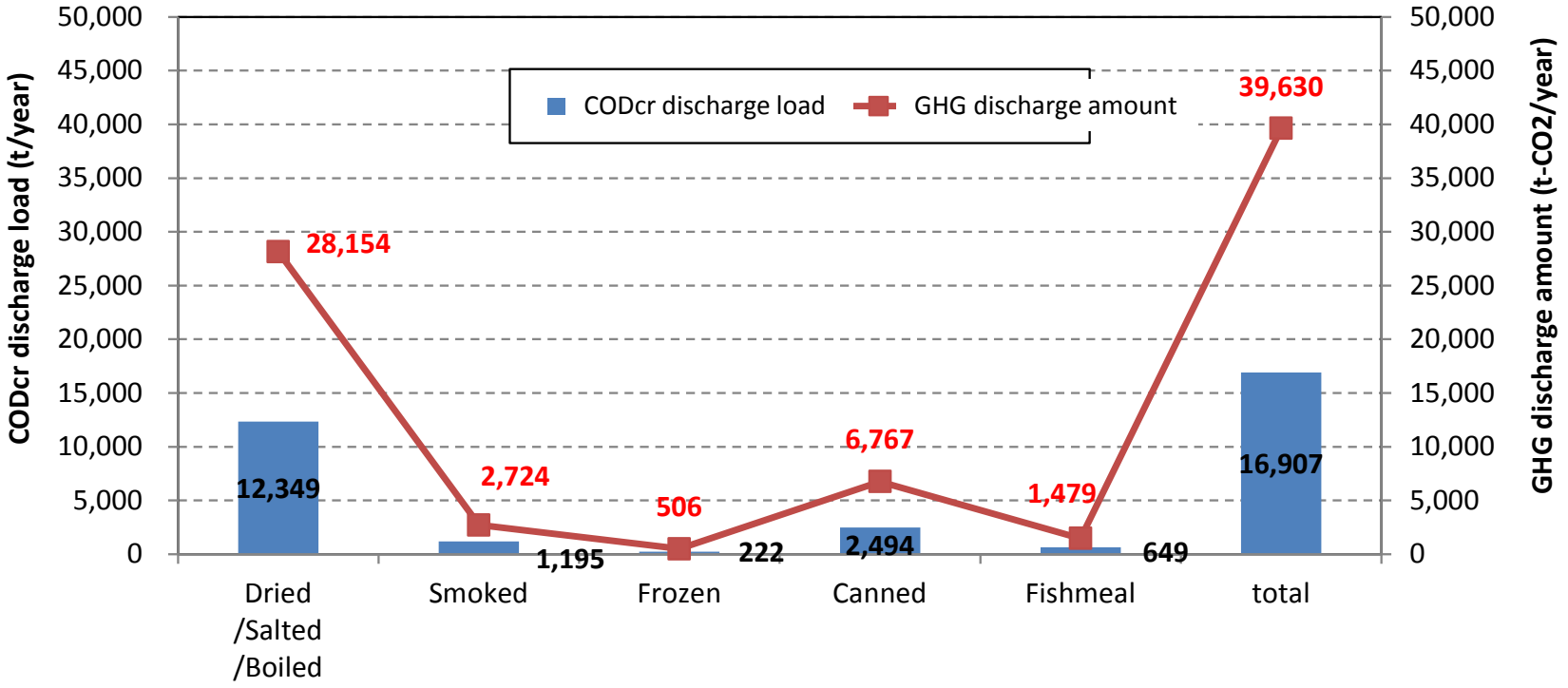




5. Estimate on effects of introduction of co-benefits type wastewater treatment

(1) Estimate on the current COD discharge load and GHG discharge amount

- Based on the production amount, wastewater amount and state of wastewater treatment facilities in fish processing factories in Indonesia, we estimated COD load and GHG discharge amount. The below schema indicates their estimates according to the industry types (kinds of fish processed products)
- Fish processing factories discharge organic material load equivalent to domestic wastewater of about 700,000 people



5. Estimate on effects of introduction of co-benefits type wastewater treatment

(2) Reduction of COD discharge load and GHG discharge amount

- Estimated COD discharge load and GHG discharge amount of the present and after the introduction of activated sludge treatment method (reference) and co-benefits type wastewater treatment
- Introduction of co-benefits type wastewater treatment is estimated to reduce COD discharge load by 97% and GHG by 79%