

Hybrid Lagoon System

- New Biological Wastewater Treatment Solution to Eutrophication -



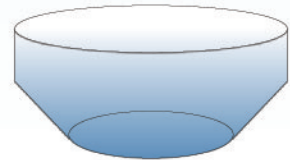
for Pollutec Lyon France on 2-5 December, 2014

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Hybrid Lagoon System ("HLS")

Hybrid Lagoon System ("HLS") is a new biological wastewater treatment technology for the highest quality of nitrogen removal and energy saving by optimising functions of activated sludge with combination of HLS's new hardware and software.

HLS has 7 strong advantages;



1. All In One

HLS's hardware called "Hybrid Lagoon", a reactor shaped single inverted circular truncated cone, provides all processes for biological wastewater treatment. Any extra tanks like aerobic tank, anaerobic tank and sedimentation tank are not required.

90%
OFF

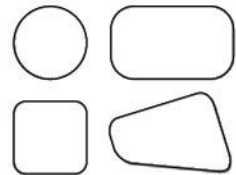
2. 90% of T-N Removed

HLS can remove over 90% of Total Nitrogen even in winter condition (on or less than 10°C of water temperature).

50%
OFF

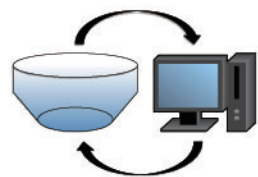
3. Cut Energy Consumption in Half

HLS consumes only 50% of energy compared with other biological wastewater treatments. HLS requires just 0.2 - 0.3 kwh per 1 ton of wastewater, compared with other biological wastewater treatment technologies that require 0.6 kwh.



4. Flexible Design

Single inverted circular truncated cone is the best shape for HLS. But, for limited space, HLS can be operated in other shapes of reactors, such as square, rectangle, and any other unique ones.



5. Real Automation

HLS's software controls all of biological wastewater treatment process without any operation by high-skilled engineers. Once you turn a key, the software checks parameters from sensors in Hybrid Lagoon and optimises variable numbers to control treatment automatically.



6. Practically Used in 300 Facilities

HLS has been already used in 300 practical facilities of municipal wastewater treatment and restoration of environment of rivers, lakes and coastal waters in Japan with official authorisation of Japanese national and local governments.

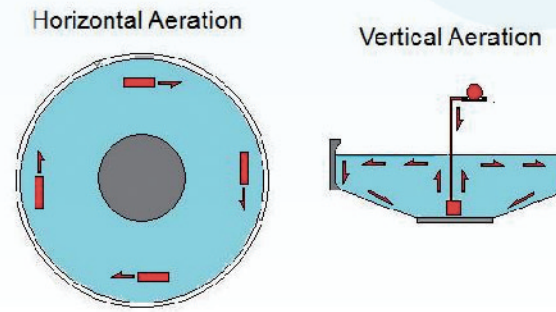


7. Already Patented

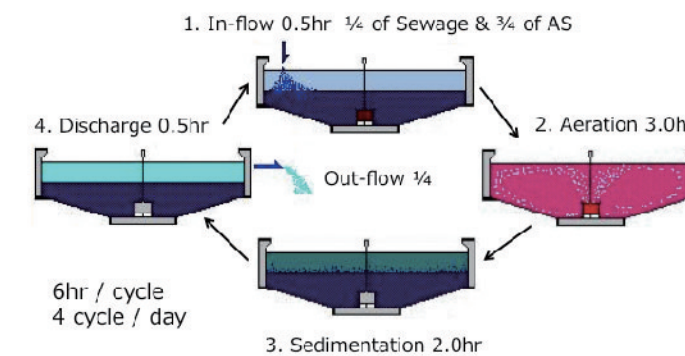
HLS was patented in Japan (4146491) and the United States (US 7,585,414 B2) through PCT patent application processes in Europe.

Structure and Operation in Hybrid Lagoon

Hybrid Aeration System



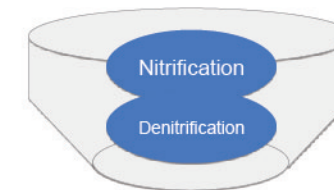
For ideal biological wastewater treatment, it is a key to control and optimise aeration for a variety of microorganism in wastewater. Hybrid Lagoon's unique structure, single reactor with aeration mixer, compressor, and sensors, enables to stir microorganism and wastewater uniformly and to optimise an amount of power required for aeration.



In Hybrid Lagoon, 4 steps of (1) in-flowing, (2) aeration, (3) sedimentation, and (4) discharge are repeated endlessly for wastewater treatment. These steps are operated in 3 (in 8 hours) or 4 cycles (in 6 hours as seen in left) per 24 hours. The number of these steps can be changed with an amount and quality of wastewater inflowing.

Software to remove Total Nitrogen

A reaction path of nitrogen in wastewater is too complex to be predicted by calculation. However, life reaction has strict regularities, that is, algorithm. HLS's software is based on this non-mathematical algorithm theory.



HLS's software optimises an amount of oxygen supplied for fluctuating microorganism by its own information such as oxygen demand. Without any computed prediction and calculation, HLS's software can always keep ideal condition that microorganism's two different functions, "Nitrification" and "Denitrification", coexist in Hybrid Lagoon.

By combination of HLS's software and Hybrid Lagoon, HLS can achieve higher quality of treatment and lower energy consumption.

Energy Saving and CO2 Reduction

HLS can reduce not only energy consumption but an amount of CO2 produced from power generation. This figure shows comparison of HLS and other biological wastewater treatment technologies.

	Hybrid Lagoon System	Other Technologies
Energy required for 1 ton of Wastewater Treatment	0.2 -0.3 kwh/m ³	0.6 kwh/m ³
- for 50000 ton per a day	5,475,000 kwh/year	10,950,000 kwh/year
CO2 removal produced for the energy by LNG (0.415 CO2kg/kwh)	2,272,125 CO2kg	4,544,250 CO2kg

HLS to Eutrophication in Water System

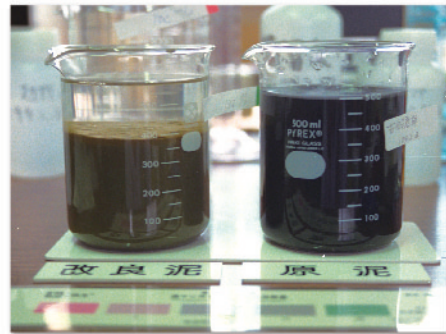
HLS is the best technology to resolve eutrophication problem in water system such as rivers, lakes, and coastal water. HLS's highest quality to remove Total Nitrogen can reduce risk of eutrophication and restore natural condition of water system.



Surface water in a lake looks still clean.



But black contaminated sludge in bottom causes destruction of an ecosystem and eutrophication.



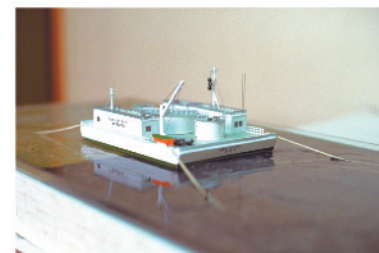
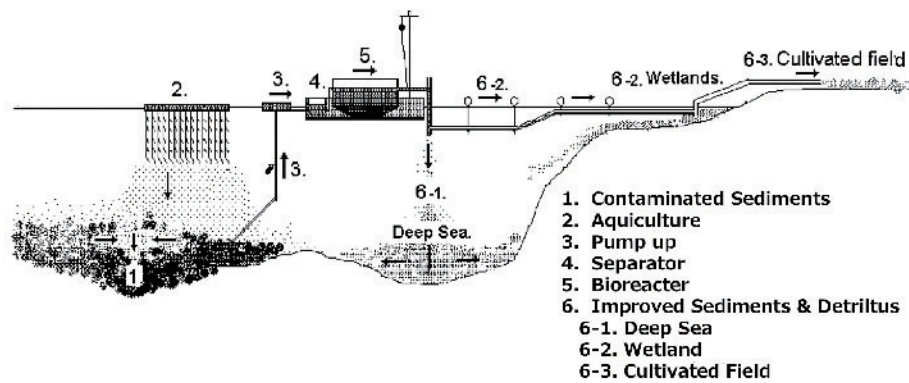
HLS treats the contaminated sludge (Right) and changes into treated sludge (Left) with rich oxygen and activated microorganism.



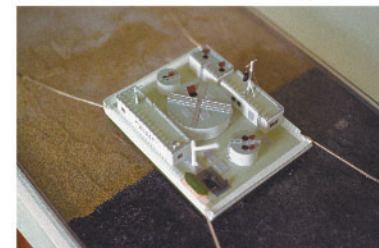
By returning the treated sludge into the bottom, its ecosystem and natural condition can be restored.



New Process for Improvement of Contaminated Sediments by Succession of Micro-Biota



Model HLS (1)



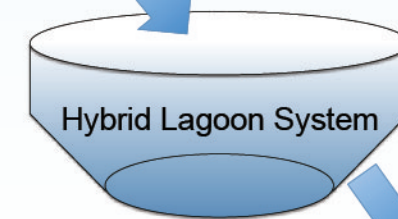
Model HLS (2)

* Used for the 2nd ICCS September 7-11, 1997 at Rotterdam, Netherlands

The figure and pictures above shows one practical example of HLS to recover natural condition in lakes. By HLS (see 5), physical properties of contaminated bottom sediment (see 1) on polluted water areas can be improved and transformed into sludge containing plenty of oxygen. By releasing the improved sludge into the polluted water areas (see 6-1 and 6-2), oxygen in the bottom can be supplied and maintained and, therefore, eliminate problems of anoxic water mass. These processes enable to restore an ecosystem in the water areas. This figure below show a summary of the processes presented to the international conference held in Netherlands in 1997.

HLS to Municipal Wastewater Treatment

Initial Treatment,
such as Screening



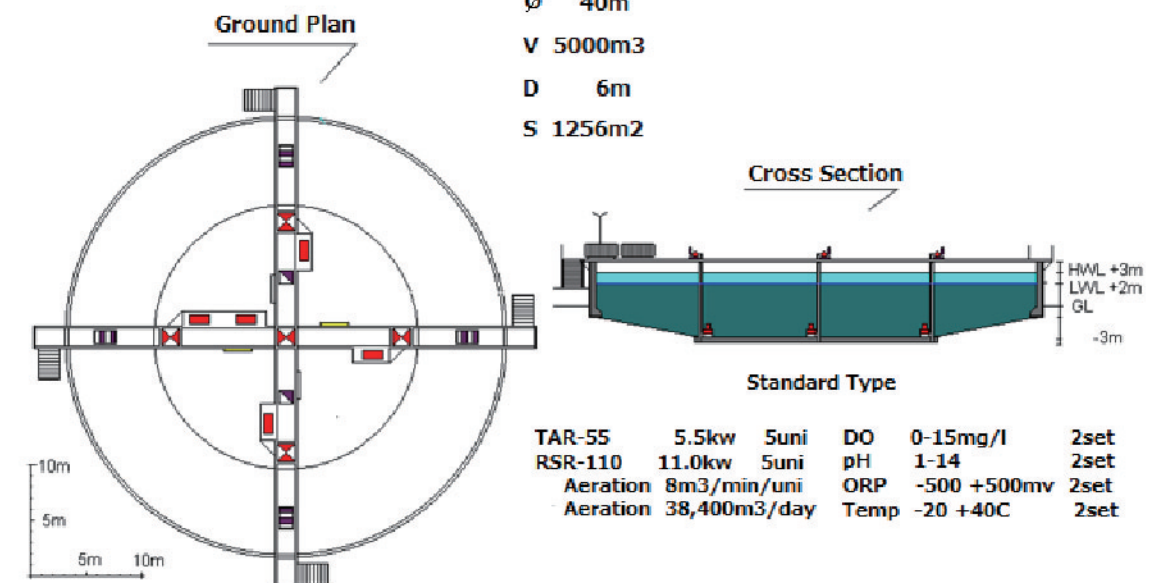
After Treatment,
such as Ultraviolet Disinfection

HLS can be used as biological wastewater treatment process in any types of municipal wastewater treatment system.

For your alternate solution for biological wastewater treatment with higher treatment capacity and lower energy consumption, HLS can be fit in existing municipal wastewater treatment system with its own initial and after (tertiary) treatment facilities as well as its electricity and pipeline system.

Hybrid Lagoon 5000 WWTW Model Standard Type

Ø 40m
V 5000m³
D 6m
S 1256m²



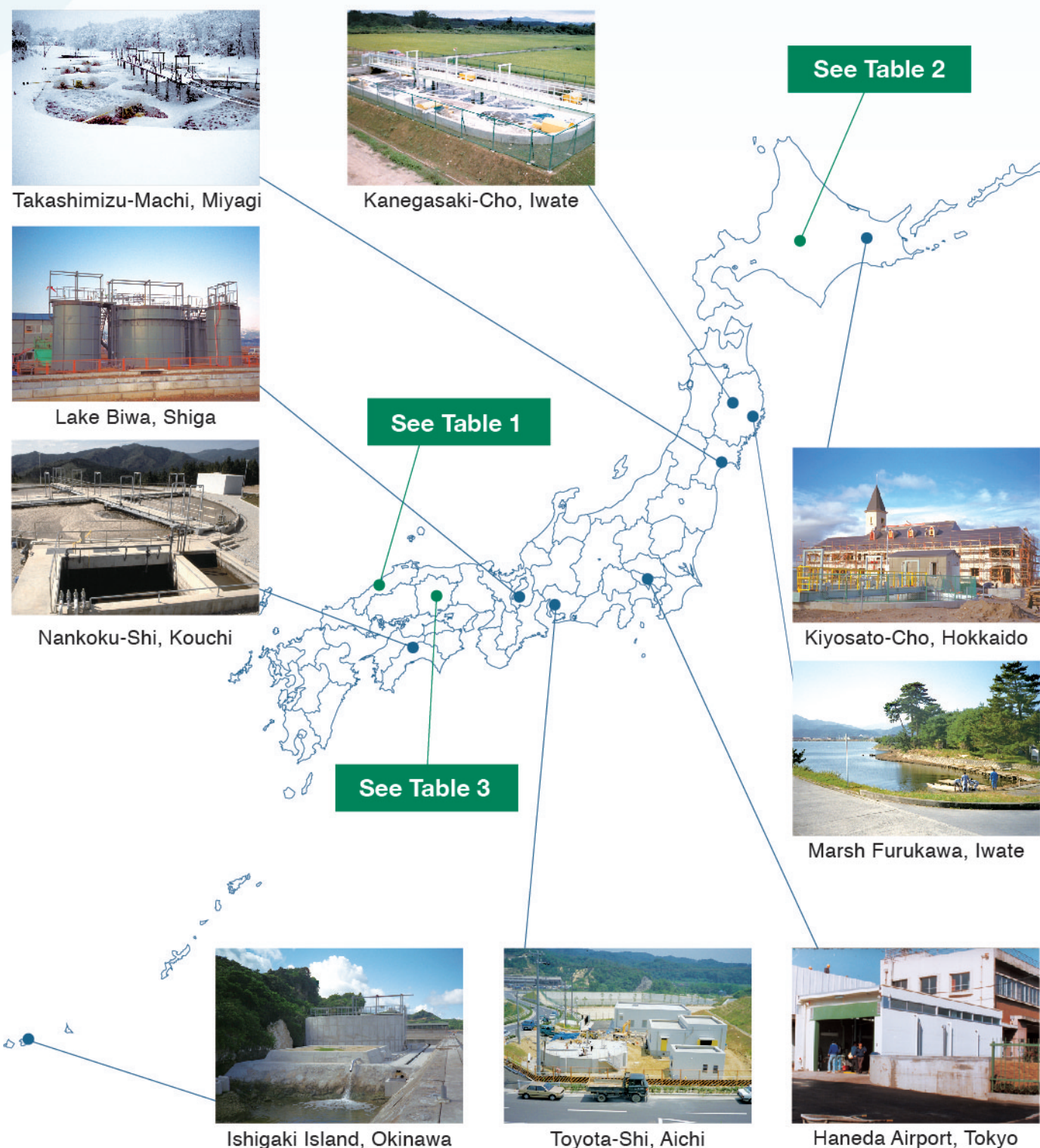
Standard Type

TAR-55	5.5kw	5uni	DO	0-15mg/l	2set
RSR-110	11.0kw	5uni	pH	1-14	2set
Aeration	8m ³ /min/uni		ORP	-500 +500mv	2set
Aeration	38,400m ³ /day		Temp	-20 +40C	2set

This figure shows the ideal graphical image of Hybrid Lagoon for treatment of 5000m³ of municipal wastewater per a day. This Hybrid Lagoon, having 1256m² of surface area, 40m of diameter, and 6m deep, has 2 sets of sensors (for DO, pH, ORP and Water Temperature) required for HLS's software and 5 aeration system containing aeration mixer and compressor. Each aeration system aerates 8m³ per a minute and 38400m³ per a day.

300 Practical Facilities under HLS in Japan

Throughout of Japan, there are 300 HLS facilities practically used for municipal wastewater treatment and restoration of environment of rivers, lakes and coastal waters. Please see below for pictures and practical data tables (in next page) on each site.



Practical Data Tables of Quality in Wastewater Treatment Plants under HLS

These data below come from three wastewater treatment plants operated by HLS. These plants have been operating under official authorisation of Japan's government with each authorisation numbers ("BCJ number").

These analysis tables of water quality are subject to an analysis method for sewage water adopted in Japan. Several third-party subcontractors designated from Japan's local governments sampled and analysed for the tables. These data are practical data used and examined for HLS's patent application.

Table 1 Sewage Treatment Plant BCJ-2355 (Aug/1995 - Sep/1996) n=12* 1m³ /0.225kWh

Item	Unit	Flow -in				Flow -out				Removal
		Max	Mini	Ave	STD	Max	Mini	Ave	STD	Ave
BOD 5	mg/l	830	71.0	225.5	219.3	7.9	0.5	2.7	2.1	98.8%
COD Mn**	mg/l	-	-	-	-	-	-	-	-	-
Total -N***	mg/l	156	13.0	44.9	36.6	4.3	1.1	2.4	2.1	94.8%
Total -P	mg/l	44	3.1	8.4	11.3	3.2	0.9	2.2	0.8	73.8%
SS	mg/l	2800	72	369	768	6.4	1.8	3.4	1.8	99.1%
Temp.	°C	25.1	9.8	18.5	-	29.5	15.6	24.1	-	-
MLSS	mg/l	-	-	-	-	6100	2000	4008	1226	-

Table 2 Sewage Treatment Plant BCJ-1850 (Aug/1991 - Jun/1993) n=12

Item	Unit	Flow -in				Flow -out				Removal
		Max	Mini	Ave	STD	Max	Mini	Ave	STD	Ave
BOD 5	mg/l	260.0	85.0	190.8	56.8	2.9	0.7	1.6	0.7	99.1%
COD Mn	mg/l	96.0	49.0	77.3	15.9	9.2	5.4	7.4	1.0	90.5%
Total -N	mg/l	50.5	25.0	37.0	7.4	3.8	1.8	2.9	0.8	92.1%
Total -P	mg/l	8.6	4.6	5.9	1.4	2.23	0.43	1.25	0.51	78.8%
SS	mg/l	222.0	40.0	136.6	52.8	9.9	0.1	1.5	2.7	90.8%
Temp.	°C	31.8	6.3	18.5	-	26.6	13.5	20.0	-	-
MLSS	mg/l	-	-	-	-	5160	2600	3578	869	-

Table 3 Sewage Treatment Plant BCJ-1560-1 (Apr/1994 - Mar/1995) n=12

Item	Unit	Flow -in				Flow -out				Removal
		Max	Mini	Ave	STD	Max	Mini	Ave	STD	Ave
BOD 5	mg/l	227	133	205	42	2.1	0.3	1.2	0.4	99.4%
COD Mn	mg/l	240	68	136	21	14.0	4.2	6.7	0.6	95.0%
Total -N	mg/l	58.8	34.4	45.2	27.3	5.3	0.6	2.3	0.6	94.0%
Total -P	mg/l	6.11	3.60	4.98	1.15	2.54	0.13	1.34	0.45	73.0%
SS	mg/l	561	64	158	44.9	5.0	0.4	1.1	2.3	99.3%
Temp.	°C	-	-	-	-	21.8	7.2	13.9	-	-
MLSS	mg/l	-	-	-	-	4618	2130	3058	521	-

* "n=12" means that samples of water for examinations were collected 12 times per a year (month).

** "Mn" means Mangan. This means the way of measurement of COD by using potassium permanganate.

*** "Total-N" means total nitrogen.

■ Rural Environment Research Association ("RERA")

Rural Environment Research Association ("RERA") is an environmental NGO founded by Dr. Jun Ui and Mr. Hiroshi Kishi in 1976. In order to resolve water environment pollution such as eutrophication and protect limited water resources, RERA has developed Hybrid Lagoon System ("HLS"), which is a combination of one single reactor (Hybrid Lagoon) and software based on non-mathematical algorithm theory.

Through official evaluation processes of Japan's government such as Ministry of Construction and Ministry of Health & Welfare, HLS has been authorised as an official technology to treat municipal wastewater, industrial wastewater and wastewater from massive farming industries,

Under the official authorisation, RERA has been engaged in design, construction management, and maintenance of over 300 facilities of municipal wastewater treatment and general waste disposal.

As a part of overseas activities, RERA participated and made presentation of HLS in international conferences such as Japan-US expert meeting at Los Angeles, United States in 1991 and 2nd ICCS at Rotterdam, Netherland in 1997.

If you have any interest, please visit our website (<http://www.rera.org>) or ask us via webmaster@rera.org.

Hybrid Lagoon under construction



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