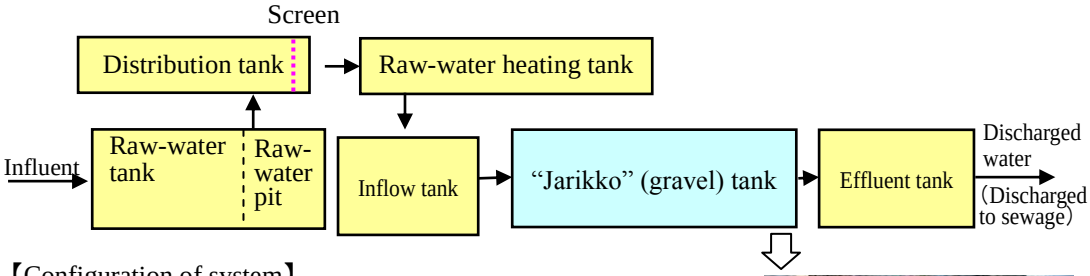
○ Overview

Technology intended for verification / environmental technology developer	Resolving system for solid organic substance “Jarikko wastewater treatment system”/Masaki Setsubi Co., Ltd.（Developer ：Aquatech Co., Ltd）
Demonstration institution （Conducted by）	Environmental Pollution Control Center, Osaka Prefecture (Environmental Management and Technology Center in Kansai)
Period of the experiment for verification	November 1, 2007 to January 31, 2008
Purpose of this technology	By repeating the aerobic and anaerobic environments in the same tank many times, the “Jarikko” (gravel) wastewater treatment system uses natural bacteria to effectively decompose organic matter.

1. Outline of the technology intended for verification



【Configuration of system】

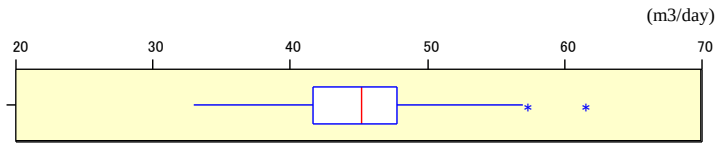
1) Body: Raw-water tank and Jarikko tank (The structures are loaded into tanks and decomposition is performed.)
2) Structures: Ball Jarikko made by bonding crushed stones with resin
3) Mechanical equipment: Screen, water distribution tank, submersible pump and blower, agitator, air distributor (on the ground), diffuser pipe (on the bottom), and electrical panel (on the ground), etc.

【Principle】

In the conventional wastewater treatment systems, solid organic matter is settled and collected by solid-liquid separation, and is then dewatered and burnt. However, in the Jarikko wastewater treatment system, natural bacteria are used to destroy the cell membranes of solid organic matter under anaerobic conditions, liquefy them and decompose the dissolved organic matter almost completely into gas and water. The anaerobic and aerobic environments are repeatedly created in the same tank many times to effectively decompose the organic matter. Aeration of the Jarikko tank is stopped for 8 hours at night to accelerate the decomposition of solid organic matter and prevent the generation of chironomidae.

2. Outline of the verification experiment

○ Outline of the location for performing the verification experiment

Project type	Food processing production
Project scale	Total floor area：2,034m^2, Quantity of products: 210,000 packs of prepared food (10.5 t)/month
Address	12−28 Kanzakicho, Amagasakish, Hyogo
Wastewater volume during the verification test period	

○ Specification and performance of the equipment used for verification

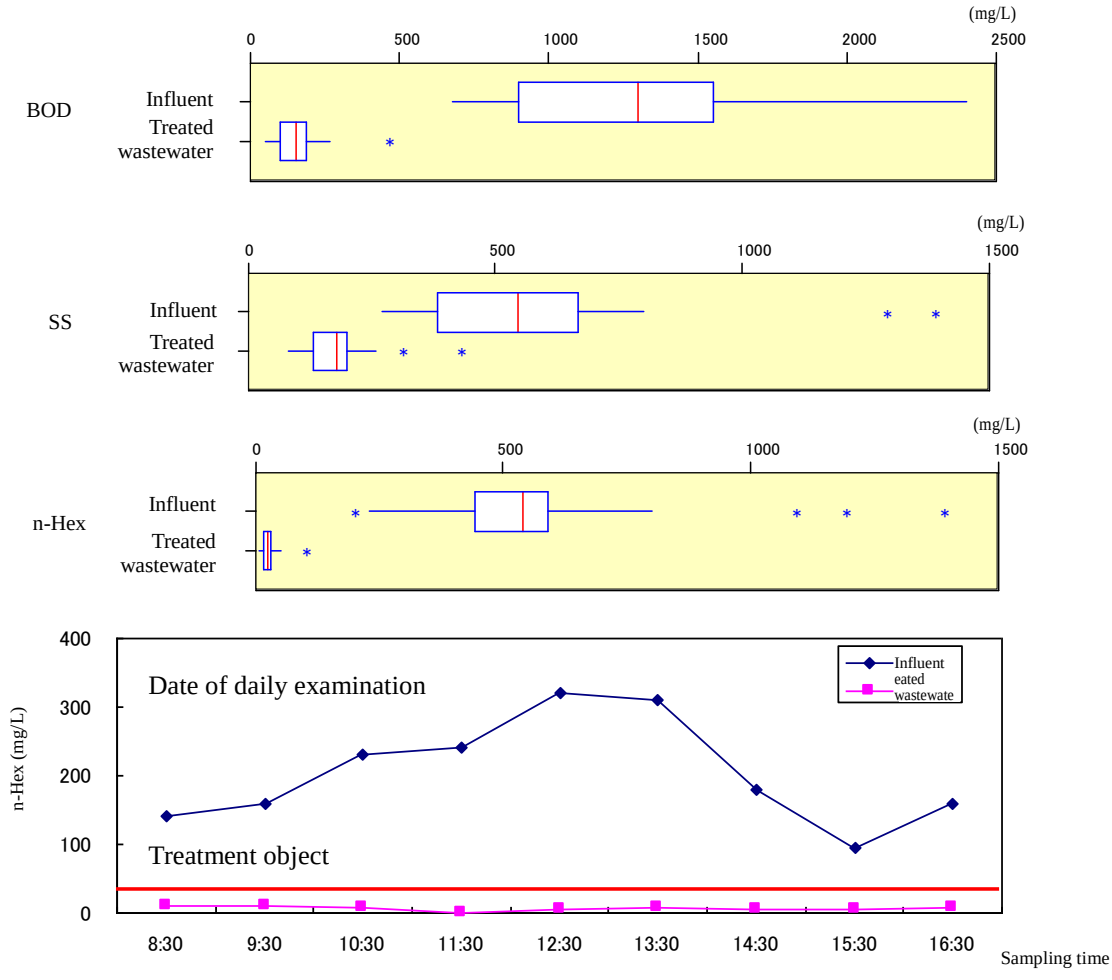
Category	Item	Specifications and water treatment capacity
Outline of the facility	Model	Jarikko wastewater treatment system
	Size and weight	4,620(W)mm×14,700(L)mm×3,500(H)mm Reinforced concrete structure built into the ground, 380,000 kg
Design conditions	Object and Treatment object	BOD:150mg/L , SS:150 mg/L, n-Hex：30 mg/L ※Average BOD and SS quantities for the period are indicated. (Reference item：pH, COD)
	Amount of wastewater per day	44m^3/day

3. Results of the verification experiment

○ Water quality verification experiment

Item	Unit	n number	Results of the verification experiment (lower adjacent value － upper adjacent value, central value, and Average value)		
			Influent	Treated wastewater	Removal ratio(%) Note1)
BOD	mg/L	18	680~2400, 1300, 1300	51~270, 155, 170	78.3~95.2, 88.0, 85.3
SS	mg/L	18	270~800, 545, 630	82~260, 180, 190	3.7~90.7, 70.8, 61.0
n-Hex	mg/L	18	230~800, 540, 600	7~52, 26, 30	84.3~98.9, 95.3, 95.3

Note 1) This was calculated by the formula based on the Verification Test Procedures (Third Version)



In November when the verification test was started (daily test on November 7 and periodic tests on November 14, 21 and 28), the amounts of BOD, SS and n-hexane extract were lower than the treatment targets on all the dates (BOD: average 150 mg/L for the period, SS: average 150 mg/L for the period, and n-hexane extract: maximum 30 mg/L). Subsequently, from early December to early January, the quantities of the substances in the treated wastewater sometimes exceeded the target quantities because the facility where the verification test was conducted manufactured large quantities of food in the busy season. Therefore, the BOD of the influent exceeded 1500 mg/L and the n-hexane extract exceeded 1000 mg/L on many days, so the contamination of influent exceeded the design conditions. In addition, the facility operated 24 hours a day from December 28 to 30, the wastewater flowed into the Jarikko tank even while the blower was stopped (20:00 on December 28 to 4:00 the next morning and 20:00 on December 29 and 30 to 3:00 the next morning) and the treated wastewater temperature dropped to near 22°C during the year change period. Furthermore, the raw-water tank was cleaned every day for about 30 minutes (the oily scum was transferred to the inflow tank) for sanitary reasons before the test was started. However, cleaning of the tank was stopped after the test was started, and was restarted on December 23. Therefore, a large quantity of oily scum which had accumulated in the raw-water tank flowed into the inflow tank in a short period, and the whole quantity of oily sludge which had accumulated in the raw-water heating tank was transferred to the inflow tank on December 7. Accordingly, this combination of adverse conditions reduced the treatment efficiency. For these reasons, regarding the quality of the treated wastewater for the whole verification test period, the average BOD was 170 mg/L, the average SS was 190 mg/L and the maximum value of n-hexane extract was 110 mg/L, thus the treatment targets were not achieved. Regarding the influent quality from January 16, the quantities of substances in the influent decreased to the same level as in November in the previous year, and the wastewater was heated in the raw-water heating tank from January 10 to 26. Therefore, on January 23, the treated wastewater contained only 110 mg/L of BOD, 120 mg/L of SS and 18 mg/L of n-hexane extract, satisfying the targets.

○ Environmental impact item

Item	Verification result
Amount of wastes	16.1 kg (wet) of waste (screenings) was generated during the verification test period, and 0.18 kg (wet) of waste was generated a day. In addition, sludge removal was not conducted during the verification test period.
Noise	The noise level based on human sense of hearing was recorded, but no abnormal sound was detected. On January 16 and 23, 2008 when periodic tests were conducted, the sound of steam blowing from the steam boiler was heard because the wastewater was heated in the raw-water tank from January 10 to January 26, 2008 to effectively treat the wastewater.
Odor	The degree of smell based on the human sense of smell was recorded. A slightly unpleasant smell like rotten onions was detected near the upper part of the Jarikko tank. However, no unpleasant smell was emitted from the exhaust of the deodorization equipment installed experimentally at the site of the verification test. The treated wastewater was slightly grayish-yellow to grayish-yellow-brown, slightly turbid and smelled slightly of kitchen waste.

○ Used resources index

Item	Verification result
Amount of electric energy used	14,375.9kWh / 92 days (156.3 kWh/day)
Amount of chemical used for waste water treatment	None

○ Operation and maintenance performance item

Maintenance item	Maintenance time per operation and maintenance frequency	Number of people and skill required for maintenance
【Daily inspection】 Clean the distribution tank and wire net cage. Clean the blower filters. Check the air volume. Clean the raw-water pit.	Once in 2days 10minutes Once a month 30 minutes Twice in 3 months 1minute Everyday 5minutes	The person must have experience and knowledge of operating the entire facility. (One person is required.)
【Special inspection】 Installation of the agitator, operation of one additional blower, change of operating time for the agitator, etc., adjustment of the steam boiler, and heat insulation work for the steam piping	8 inspections were conducted during 8 days, taking a total of 17 hours	This inspection must be done by persons who have experience and knowledge of operating and maintaining the entire facilities (two engineers for developing environmental technology).

○ Qualitative remark

Item	Remark
Remark on water quality	 Treated wastewater Influent
Operations required for initiation	Since the existing system was used, no installation work was required.
Operations required for shutdown	No work for stopping the system was performed because it was continuously operated after the verification test was finished.
Reliability of the equipment intended for verification	Since a large quantity of sludge (39.2 kg) accumulated in the raw-wastewater heating tank, the piping to the inflow tank became clogged and the influent almost overflowed from the tank. After taking countermeasures, the tank operated normally.
How to solve the problems	[1] The sludge that had accumulated in the raw-water heating tank was temporarily removed. [2] An agitator was installed in the raw-water heating tank.
Evaluation of the instruction manual of operation and maintenance	The manual does not require any corrections.
Others	－

(Reference information)

Note : The information on this page was provided for technology publication by the engineers who developed this environmental technology on their own responsibilities and so is not included in the verification this time.

○ Product data

Items		Column to be filled in by the environmental technology developer			
Name/type		Jarikko wastewater treatment system			
Manufacturer (distributor)		Masaki Setsubi Co., Ltd. (Developer : Aquatech Co., Ltd)			
Contact address	TEL/FAX	TEL : 06-6933-2090 (TEL ; 042-628-7373) FAX ; 06-6932-1415 (FAX ; 042-628-1141)			
	Web address	http;//www.masakis.co. jp (http;//www.aquatech.co.jp)			
	E-mail	setsubi@masakis.co.jp (eto@aquatech.co.jp)			
Size and weight		W320mm×D285mm×H130mm・4.0kg			
Necessity for pre-treatment and post-treatment		None			
Supplementary facility		Screen, water metering tank, air distribution header, submersible blower, submersible pump, sirocco fan, and electrical panel			
Life of the equipment		The life of the Jarikko system is about 40 to 50 years. The life of the equipment depends on the specifications of each manufacturer.			
Time for initiation		3 days			
Approximate cost (yen)		Expense item	Unit price	Quantity	Total
		Initial cost			38,000,000yen
		Cost of equipment		1 set	25,000,000yen
		Engineering cost		1 set	13,000,000yen
		Running cost(monthly)			59,300yen
		Power rate	12yen/kWh	4,944 kWh	59,300yen
		Per 1 m^3 of treated wastewater (Based on the assumption that 44 m^3 of wastewater is treated a day)			45yen

○ Other information from the manufacturer

- ●Different from the activated sludge system that uses only an aerobic environment, the aerobic and anaerobic environments are repeated 20 times while wastewater flows down 20 m.
- ●As a result, fats and sludge are solubilized and decomposed almost completely into gas and water. Since no separated oil and sludge are generated, there is no sludge, etc. to be treated or disposed of.
- ●Regarding the operation and maintenance cost, there is only the cost of power for operating the equipment such as the blower and pump. This system requires no other costs such as for chemicals, bacteria injection and sludge disposal, and no labor for control.
- ●Since the Jarikko treatment facility is built into the ground and no machine room is required, the ground space above it can be used for a parking lot, etc.