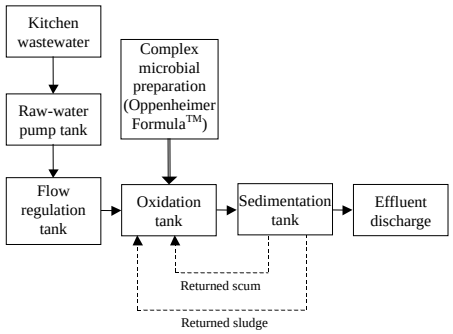
○ Overview

Target verification technology/environmental technology developer	Complex microbe/tornado biological reaction system / BioRangers, Inc.
Verification organization (Conducted by)	Environmental Pollution Control Center, Osaka Prefecture (Environmental Management and Technology Center in Kansai)
Verification-test period	1st stage: Nov. 25, 2003 to Dec. 19, 2003 2nd stage: Jan. 8, 2004 to Mar. 4, 2004
Object of technology	a. Decomposition of the pollutants in oil-containing organic wastewater b. Suppression of the generation of waste (including sludge) and foul odor

1. Summary of the target verification technology

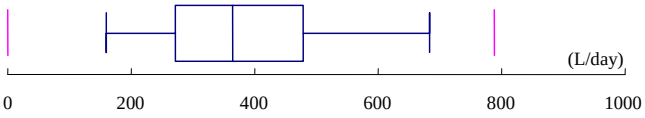


Principle

A biological reaction system, by bringing complex oil-degrading microbes (Oppenheimer Formula™) into contact with oils and supplying oxygen needed for efficient decomposition. Oils and other organic matter are decomposed more efficiently in the oxidation tank, as microbes, oils, and oxygen are efficiently brought into contact with each other. Following solid/liquid separation into processed wastewater and sludge in the sedimentation tank, the processed wastewater is discharged as the effluent. The sludge obtained through sedimentation separation is fed back to the oxidation tank, where the excess sludge is reduced in volume, thereby enabling high-efficiency, low-cost wastewater treatment.

2. Summary of the verification test

○ Summary of the verification-test site

Type of business	Restaurant (located on a college campus) * This verification test is conducted using a test plant installed by the environmental-technology developer at the verification-test site assigned by the verification organization.
Business scale	500 seats; 2,000 guests/day
Location:	1-1, Gakuen-cho, Sakai City, Osaka Prefecture
Wastewater flow rate during the verification-test period	

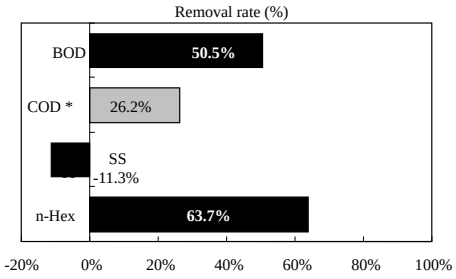
○ Specification and processing capacity of the target verification apparatus

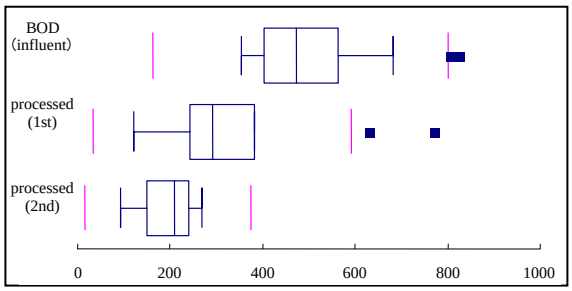
Classification	Item	Specification and processing capacity
Summary of facility	Name/type	BRS-100-110 (test plant)
	Size and weight	Oxidation tank: φ556 mm × 1,050 mm (H) (actual effective capacity: 0.105 m^3); approximately 40 kg Sedimentation tank: φ506 mm × 1,050 mm (H) (actual effective capacity: 0.084 m^3); approximately 35 kg
Design conditions	Target substance	PH, BOD, SS, and n-Hex
	Daily wastewater flow rate	0.3 m^3/day (1st), and 0.45 m^3/day (2nd)
	Inflow period	24 hours
	Hourly inflow rate	0.012 m^3/hour (1st) and 0.018 m^3/hour (2nd)
	Influent-wastewater quality	(pH): 5.0-10.0; (BOD): 850 mg/L; (SS): 600 mg/L; and (n-Hex): 840 mg/L
	Processed-wastewater quality	(pH): 5.1-8.9; (BOD): 600 mg/L; (SS): 600 mg/L; and (n-Hex): 30 mg/L
Others	Chemicals used	Microbial preparation (Oppenheimer Formula I): 1 g/day

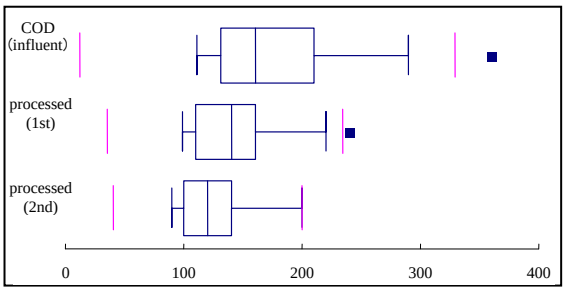
3. Verification-test results

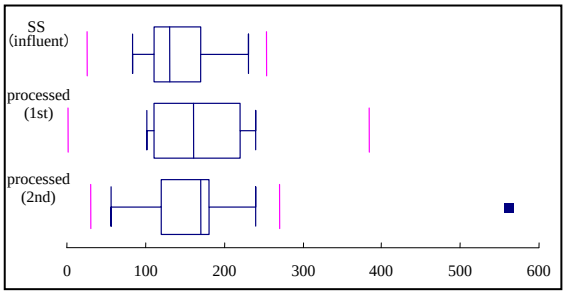
○ Verification items concerning water quality

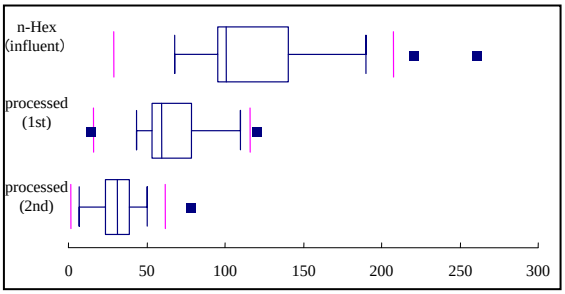
Item	Unit	Verification results (lower neighboring value to higher neighboring value, and median value)			
		Influent wastewater		Processed (effluent) wastewater	
pH	-	5.0-7.1	6.3	5.9-6.7 6.2-6.9	6.3 6.5
BOD	mg/L	350-680	470	120-380 94-270	290 210
COD *	mg/L	110-290	160	98-220 90-200	140 120
SS	mg/L	83-230	130	100-240 56-240	160 170
n-Hex	mg/L	67-190	100	43-110 7-50	59 31











Note 1: Median value of removal rates determined daily: "(load in influent wastewater - load in processed wastewater) / load in influent wastewater"
Note 2: * indicates items the removal of which is not intended in the target verification apparatus.
Note 3: Number of pieces of influent-wastewater data: 22; number of pieces of processed-wastewater data: 9 (1st) and 13 (2nd)

○ Items concerning environmental impact

Item	Verification result
Amount of generated sludge	No withdrawal of excess sludge during the verification period
Amount of generated waste	No observable waste generated during the verification period
Noise	59 decibels (including environmental noise other than that from the facility)
Odor	Odor index: 13 to 14; Odor intensity: 1 to 3 (6-level odor-intensity scale)

○ Items concerning used resources

Item	Verification result
Electricity consumption	9.0 kWh/day
Wastewater treatment chemicals and other consumption	Microbial preparation (Oppenheimer Formula I): 1 g/day

○ Items concerning operation and maintenance performance

Control point	Time and frequency of maintenance and management	Number and technical skill of the operators needed for operation and maintenance
Daily maintenance (addition of microbial preparation, inspection and adjustment of instruments, confirmation and adjustment of processing conditions, and others)	60 minutes (average: 60 minutes) (Once per day)	One operator required for daily maintenance. Specialized knowledge and experience required for operation, maintenance, and management of the facility in general, instruments and electric devices.

○ Qualitative findings

Item	Findings
Water-quality findings	 Influent wastewater  Processed wastewater
Period required for startup	6 to 7 days
Reliability of the target verification apparatus	The facility generally operated normally during the verification period. However, the malfunction of an influent pump and a return sludge pump, electric leakage, and other problems were observed.
Evaluation of the operation and maintenance manual	No particular problems to be solved.
Others	-----

(Reference information)

All information on this page is provided by the environmental-technology developer on its own authority; the Ministry of the Environment and the verification organization are in no way responsible for the content of this page.

○ Product data

Item		Description given by the environmental-technology developer
Name/type		Complex microbe/tornado biological reaction system / 10-100
Manufacturer (distributor) name		BioRangers, Inc.
Contact address	Tel/Fax	TEL: (03) 5833-7181 / FAX: (03) 3863-1520
	Website	www.bri.co.jp
	E-mail	info@bri.co.jp
Size and weight		(Oxidation tank 1012) φ1,200 mm × 1,400 mm (H); effective capacity: 1.154 m^3; approximately 100 kg(Sedimentation tank 1515) φ1,500 mm × 1,800 mm (H); effective capacity: 2.120 m^3; approximately 160 kg
Design calculation	Oxidation tank	（(Required holding time): 0.7838 hours; (required effective capacity): 0.3266 m^3; (designed capacity): 1.154 m^3
	Sedimentation tank	(Effective capacity): 1/6 or less of the daily wastewater flow rate; (load per water surface area): 8 m^3/m^2•day or less(Water surface area of tank): 1.767 m^2; (required effective capacity): 1.6667 m^3
	Main instruments	(Circulation pump): 0.09 m^3/min, φ40, 0.40 kW, 1 piece (Scum withdrawal pump): 0.03 m^3/min, φ16, 0.02 kW, 1 piece (Sludge withdrawal pump): 0.03 m^3/min, φ16, 0.02 kW, 1 piece (Control panel): Indoor & outdoor, relay-type, timer controlled
Necessity of pre- and post-treatment		None
Additional facility		Pump tanks (raw water, effluent discharge), flow regulation tank, and automatic microbial-preparation-adding device
Life of the target verification apparatus		Tanks: 15 years; pumps and other instruments: 3 years

Approximate cost (yen)	Item	Unit cost	Quantity	Total
	Initial cost			3,600,000
	System		1 set	3,000,000
	Electric and piping work		1 set	300,000
	Other apparatuses		1 set	300,000
	Operating cost (month)			46,000
	Sludge disposal	-----	-----	-----
	Waste disposal	-----	-----	-----
	Electricity	200 yen/day	30 days	6,000
	Water	-----	-----	-----
	Wastewater treatment chemicals	50,000 yen/kg	0.5 kg/month	30,000
	Other consumables	-----	-----	-----
	Maintenance and management subcontracting	10,000 yen	Once/month	10,000
	Per m^3 of processed wastewater (assumed amount of processed wastewater: 300 m^3/month)			153

○ Other information from manufacturer

- Assumed inflow rate: 10 m^3/day; assumed oil concentration (n-hexane extractable substances): 100 mg/L
- Oppenheimer formula I was used as the microbial preparation.
- The entire system is placed on the ground.
- The maintenance and inspection include examination of pH, DO, MLSS, and SV, adjustment of the timer, examination of instruments, and others. An apparatus equipped with an automatic microbial-preparation-adding device was used. Travel expenses are excluded.