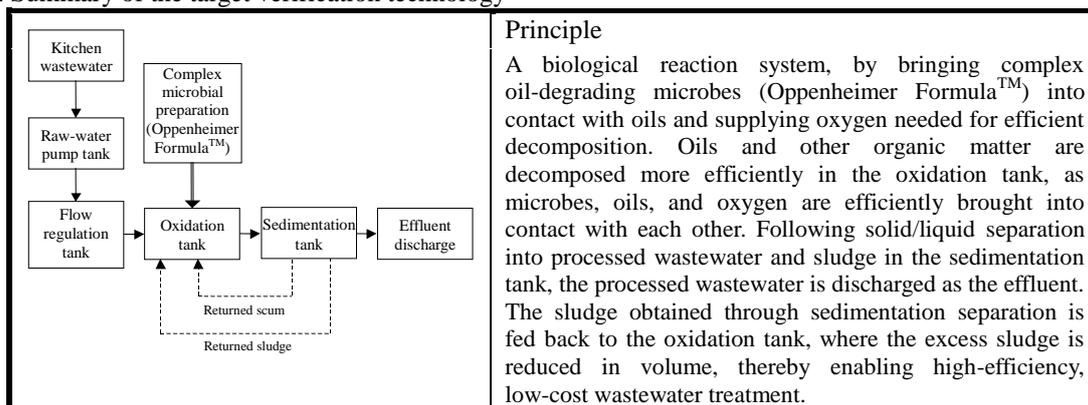


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○ Overview

| | |
|---|---|
| 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



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 | |

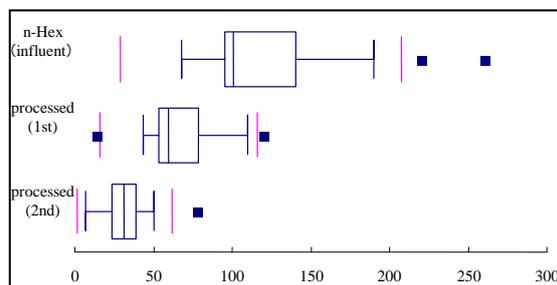
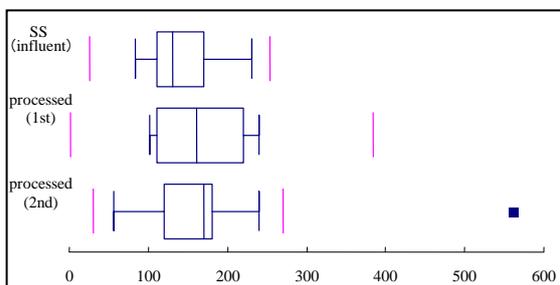
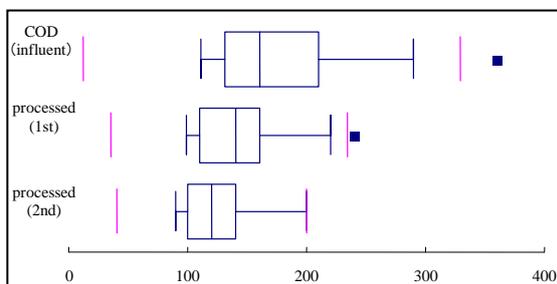
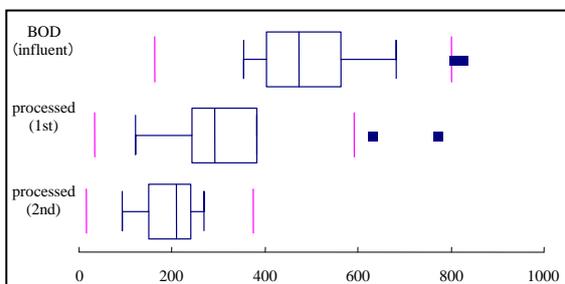
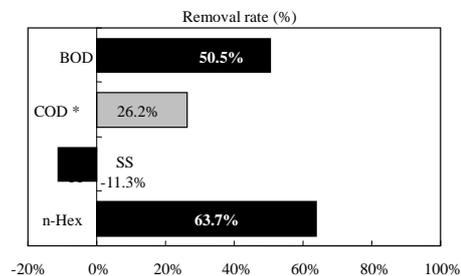
○ Specification and processing capacity of the target verification apparatus

| 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 |
| Others | Processed-wastewater quality | (pH): 5.1-8.9; (BOD): 600 mg/L; (SS): 600 mg/L; and (n-Hex): 30 mg/L |
| | 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 | 6.3 |
| BOD | mg/L | 350-680 | 470 | 120-380 | 290 |
| COD * | mg/L | 110-290 | 160 | 94-270 | 210 |
| SS | mg/L | 83-230 | 130 | 98-220 | 140 |
| n-Hex | mg/L | 67-190 | 100 | 43-110 | 59 |
| | | | | 7-50 | 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 |  <p style="text-align: center;">Influent wastewater Processed wastewater</p> |
| 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 contents 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) ϕ 1,200 mm \times 1,400 mm (H); effective capacity: 1.154 m ³ ; approximately 100 kg (Sedimentation tank 1515) ϕ 1,500 mm \times 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, ϕ 40, 0.40 kW, 1 piece (Scum withdrawal pump): 0.03 m ³ /min, ϕ 16, 0.02 kW, 1 piece (Sludge withdrawal pump): 0.03 m ³ /min, ϕ 16, 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 m³/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.