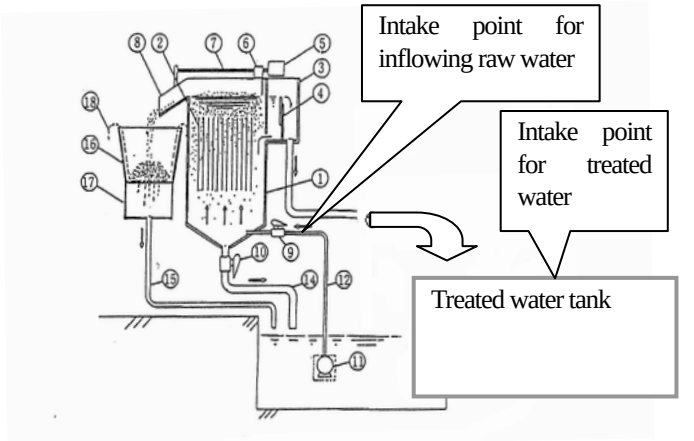
○ Overview

| | |
|---|---|
| Demonstration institution | Saitama-prefectural Environmental Analysis & Research Association |
| Period of the experiment for verification | From October 24, 2007 to January 31, 2008 |
| Purpose of this technology | This technology includes a system that makes the oil in organic wastewater rise to the surface for collection by an electrolytic response. The system works as a unit that removes oil and as an auxiliary unit for grease interceptor that improves the quality of wastewater. |

1. Outline of the technology intended for verification

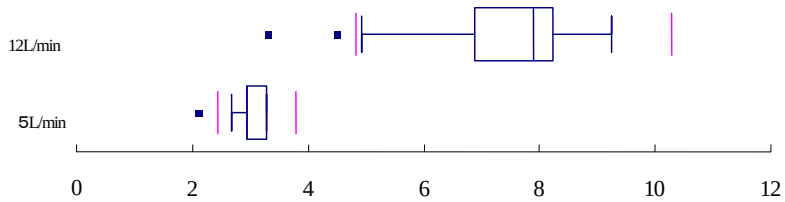



Principle

In the electrolysis tank, wastewater is electrified between the anode (aluminum electrode) and cathode (iron electrode). Then, aluminum hydroxide generated by the anode adsorbs the pollutant, and transforms it into floc. Hydrogen gas generated by the cathode raises the floc to the surface, which separates the pollutant from wastewater.
This technology is environment-friendly without chemical usage.

2. Outline of the verification experiment

○ Outline of the location for performing the verification experiment

| | |
|---|---|
| Project type | Student's cafeteria<br>(cafeteria #1, building #6 of Nippon Institute of Technology) |
| Project scale | Total floor area: 1404.7 $m^2$ Number of seats: 1,000 |
| Address | 4-1 Gakuen-dai Miyashiro-machi Minami-saitama-gun Saitama |
| Amount of wastewater during the verification experiment (L/min) |  <br>※What was calculated in the verification experiment was not the total amount of wastewater treated at the experiment location, but the amount of two types of wastewater transferred by the metering pump. |

○ Specifications and performance of the equipment used for verification

| Category | Item | Specifications and performance |
|---|---|---|
| Outline of the facility | Model | DZ101KC |
| | Size and weight | *W* =770 mm×*D* =1,300 mm×*H* = 1,300 mm 100kg |
| Design conditions | Object | Normal-hexane extracts(*n*-Hex) biochemical oxygen demand(BOD) |
| | Amount of wastewater per day | Actual result: 7.5 $m^3$/day (12 L/min setting)<br>2.9 $m^3$/day (5 L/min setting) |
| | Treatment object | *n*-Hex less than 30 mg/L (the original setting was more than 90% of removal rate for both *n*-Hex and BOD). |

3. Results of the verification experiment

○ Water quality verification items

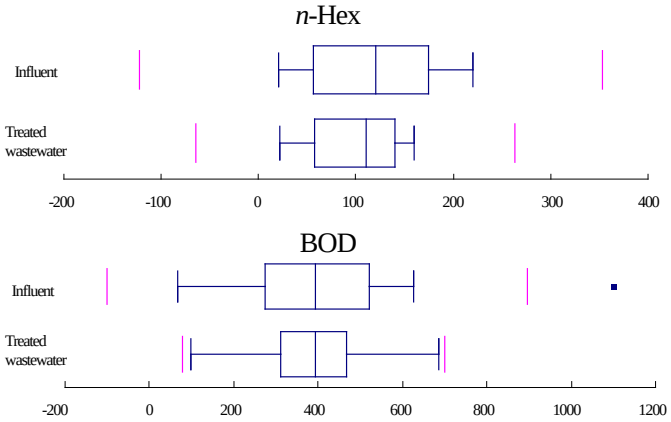
| Items | Unit | Verification result (bottom line-top, median)<br>upper: result of the research #1~#4*2<br>lower: result of the research for improvement and follow-up | | |
|---|---|---|---|---|
| | | Influent | Treated wastewater | Removal rate (%)*1 |
| *n*-Hex | mg/L | 20-220 (120) | 22-160(110) | 8.3-38.9 (25.7) |
| | | 24-110 (60) | 6-36 (20) | 25-91.9 (66.7) |
| BOD | mg/L | 66.4-625 (394) | 99-685 (393) | 1.0-60.3 (23.2) |
| | | 167-463 (318) | 122-337 (224) | 7.5-38.5 (14.1) |

*1.The removal rate was calculated according to the formula Rate=[(pollution loading amount of influent)-(pollution loading amount of treated wastewater)]/(pollution loading amount of influent)

*2.The results of the research #1~#4 indicates the water quality in the daily research, the weekly research, the regular research#1~#4.

(1)Result of the research #1~#4

According to the result of the research #1~#4, the removal rates for both *n*-Hex and BOD were low under the following operating conditions:(12L/min, voltage=5 V, current=20 A)

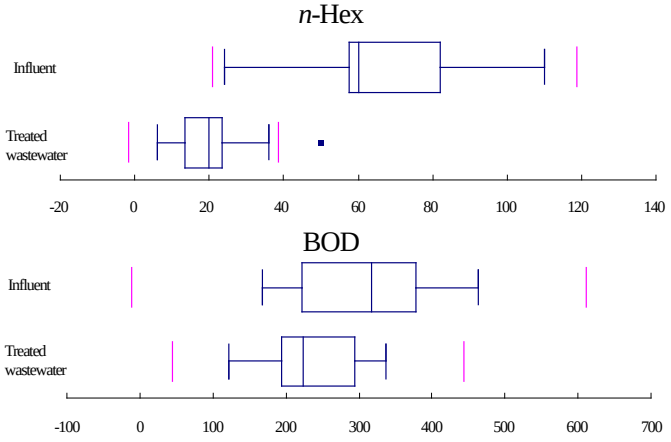



(2)Result of the research for improvement and follow-up

After the examination by the verification committee, the operating conditions were improved and the following results were obtained.

Improved specifications: The inflow was changed from 12 to 5 L/min, the voltage was changed from 5 to 8 V, and the current was changed from 20 to 40 A.

As a result of the improvement, the removal rate of *n*-Hex increased, and therefore, the quality of the wastewater met the quality standards (less than 30 mg/L). Moreover, the removal rate of BOD increased, although, this increase was not sufficient to make the wastewater quality meet the quality standards.



○ Environmental impact items

| Items | Verification result |
|---|---|
| Amount of sludge | ~3.7 kg/day as oily industrial wastes (content: 69.3%) |
| Amount of wastes | Nothing remarkable other than sludge |
| Noise | 65 dB in treatment facilities,63 dB in neighboring areas |
| Odor | Odor index: less than 10 |

○ Used resources index

| Items | Verification result |
|---|---|
| Amount of electric energy used | Electrolysis voltage: 5 V current: 20 A 0.14 W/L<br>voltage: 8 V current: 40 A 1.07 W/L |
| Amount of chemical used for wastewater treatment | No chemical was used |
| Wastage of the aluminum sheet used as electrodes | The aluminum sheet (7.2 kg) to which a voltage of 5 V and a current of 20 A is applied should be changed every 450 h.(erosion 37.5% of the weight)<br>The aluminum sheet (7.2 kg) to which a voltage of 8 V and a current of 40 A is applied should be changed every 130 h. (erosion 17.9% of the weight) |

○ Operation and maintenance performance item

| Maintenance items | Maintenance time per operation and maintenance frequency | Number of people and skill required for maintenance |
|---|---|---|
| Periodic check | 60 min (twice a month) | One person having knowledge of operation and maintenance |
| Replacement of aluminum sheets | 30 min (once every 600 h for electrolysis) | one person having knowledge of operation and maintenance |

○ Qualitative remark

| Items | Remark |
|---|---|
| Remark on water quality | Although the desired water quality after the treatment could not be achieved the quality of the wastewater after *n*-Hex met the waste quality standards (less than 30 mg/L) , as seen in the follow-up research after improvement(the average was 22 mg/L.) . In addition, it is expected that technical improvements such as batch-type operation might improve the removal performance.<br>5L/min  <br>Influent Treated wastewater<br>Batch expriment  <br>Inflow 15 30 45 |
| Time required for initiation | 30 min(one person) |
| Time required for shutdown | 1 min |
| Reliability of the equipment intended for verification | There was no trouble with the equipment intended for verification during the period of the verification experiment. |
| How to solve the problems | The instruction manual is useful for solving problems. |
| Evaluation of the instruction manual of operation and maintenance | There is nothing in particular to be improved. |
| Others | Although the grease trap had been cleaned once a week normally, that was not cleaned during three months under the examination. |

(Reference information)

Note: The information on this page is what the environmental engineering developer applied on behalf of the technical bulletin on his own responsibility, and is an exception to the verification.

○ Product data

| Items | | Description given by the environmental-technology developer | | | |
|---|---|---|---|---|---|
| Name/type | | Electrolytic wastewater treatment unit (DZ101KC) | | | |
| Manufacturer (distributor) | | NT labo Co., Ltd. | | | |
| contact address | TEL / FAX | TEL: (048)940-2243　FAX: (048)940-2246 | | | |
| | Web address | http://www.nt - labo.co.jp | | | |
| | E-mail address | info@nt-labo.co.jp | | | |
| Size and weight | | *W* =770 mm×*D* = 1,300 mm×*H* = 1,300 mm 100kg | | | |
| Necessity for pre-treatment and post-treatment | | None | | | |
| Supplementary facility | | As for the treated wastewater and after-load raw water, the installation of a sedimentation tank or an overflow weir after treatment tank is required for settling the suspended solids(SS). | | | |
| Life of the equipment intended for verification | | More than 10 years for vinyl chloride and steel work | | | |
| Time for initiation | | 30 min (performance in the verification experiment) | | | |
| Approximate cost (yen)<br><br>Data with the * mark are calculated from the result of the verification experiment | | | Unit price | Quantity | Total |
| | Initial cost | | | | 2,200,000 |
| | | main body　DZ101KC | 2,000,000 | 1 | 2,000,000 |
| | | Installation costs(including trial operation) | 150,000 | 1 | 150,000 |
| | | Transportation cost | 50,000 | 1 | 50,000 |
| | Running cost（monthly） | | | | 79,475 |
| | | Electric power consumption cost | 20 yen/kWh | 580 kWh | 11,600 |
| | | Maintenance cost | 30,000 yen/month | 1 | 30,000 |
| | | Waste disposal cost Waste transportation cost | 25 yen/kg<br>25,000 yen/use | 215 kg (8.6 kg/day) | *5,375<br>*25,000 |
| | | Other expenses(aluminum sheet) | 2,500 yen/sheet | 6 (used for two months) | *7,500 |
| | | Cost per 1 $m^3$ of treated wastewater (the amount of treated wastewater is assumed to be 220 $m^3$/day). | | | 361 yen |

○ Information from other manufacturers

- Contrary to the aim of the verification experiment, the system could not treat the expected inflow sufficiently. However, after the improvement, the removal of *n*-Hex was affected.
- Low-priced electrodes are used for removal by electrolysis, which realizes high performance and low running cost.
- You can customize the size and the performance of the unit, depending on the circumstances.
- Once the unit is installed, you can operate it on the same day.