



# **Example of Management of Nitrogen Removal in a Night Soil Treatment Plant,**

## using the On-Line Total Nitrogen Analyzer TN-4100

To prevent eutrophication of closed water areas, agreements with industry have been established which regulate environmental standards, discharged water standards, and type of water area specifications with respect to nitrogen. In addition, it is expected that water discharge controls with respect to total nitrogen (TN) will be reinforced. Devices for measuring TN has been developed, the Shimadzu On-Line Total Nitrogen Analyzer TN-4100 and Total Organic Carbon/Nitrogen Analyzer TOCN-4100. Here we would like to introduce the features of the TN-4100, and the results achieved when this is used to manage nitrogen removal at a night soil treatment plant.

## Outline of a night soil treatment plant

The TN-4100 is installed in a night soil treatment plant, such as the one shown in the figure below (see Fig. 1 for location of the device).

- Processing method: Membrane separation high load biological nitrogen removal system (membrane in liquid) + Advanced treatment (coagulation/filtration (membrane in liquid) + adsorption to activated carbon)
- Scale of treatment: 130kL/day (excrement: 90kL, septic tank sludge: 40kL)

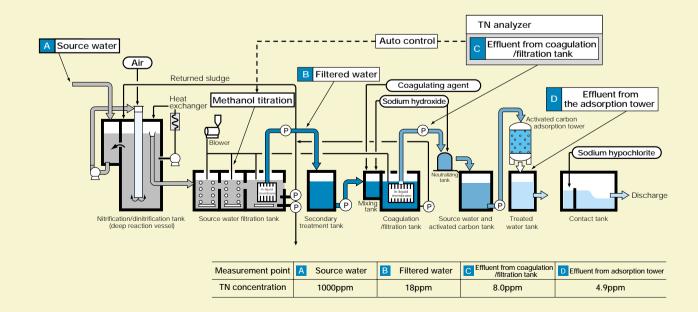


Fig. 1 Flow line diagram of night soil treatment

## Purpose

In nitrification/dinitrification process, methanol is added in order to reduce nitrate ions derived from ammonia to nitrogen gas. If the amount of methanol added is not enough, the reaction of the nitrate ions is not complete, and if the amount is too great, the COD of the treated water increases and the life of the activated carbon is diminished. Therefore it is recommended that the amount be continually controlled according to the change in load. In this type of treatment process with a feedback operation, rapid measurement of TN concentration is indispensable.

### **Problems with conventional methods**

Conventionally, the TN concentration is measured by manual analysis, and is associated with the following problems:

- Measurement of TN concentration takes a few hours so it cannot be used for control purposes;
- Surplus amounts of methanol are being added so there is unnecessary cost;
- In addition, the surplus addition of methanol diminished the life of the activated carbon;
- TN concentration is measured manually incurring personnel and laboratory costs.

## Measuring Conditions

Using the TN-4100 the TN concentration of the discharged water following dinitrification is continually monitored. The measurement conditions are shown below:

Measurement cycle: 30 minutes (The TN-4100 specification shows minimum cycle to be approx. 4 minutes.)

Measurement range: 0 - 50 ppm N

### Results

Fig. 2 shows the measurement results and a comparison with the manual analysis results. (The periods where device measurement results are missing are where processing was halted due to inspections at the soil treatment plant, and no treated water was being supplied to the device.) As shown here, there is good correlation with the manual results.

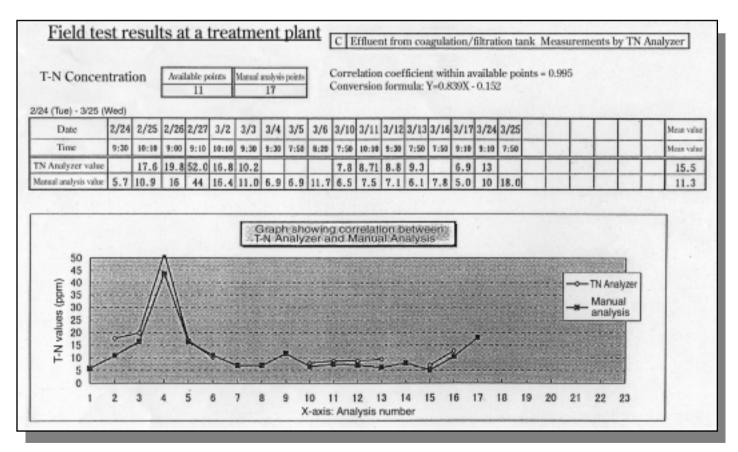


Fig. 2 TN measurement before controlling amount of added methanol

## Application of TN Measurement Results in Controlling

Based on the measurement results of the TN-4100, the amount of added methanol is controlled so that a TN concentration of equal to or less than 10ppm after dinitrification is maintained. (A few ppm of TN is removed at the next stage, the activated carbon treatment, so the final discharged water has approx. 5ppm of TN.) The results are shown in Fig.3. With this device used for controlling the amount of methanol addition, the TN concentration following dinitrification has been stabilized at approx. 8ppm.

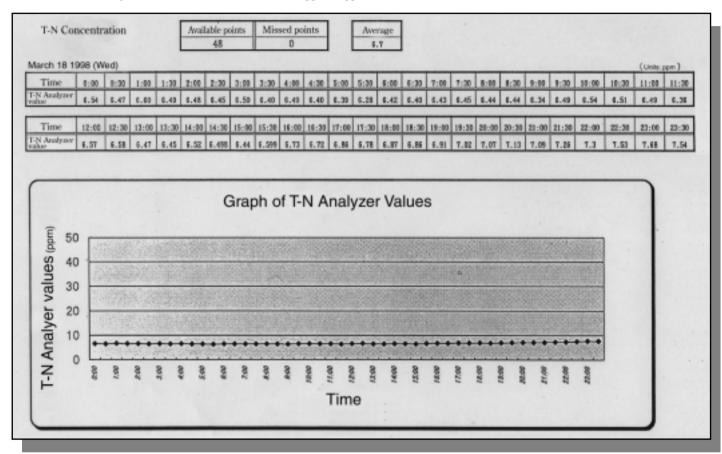


Fig. 3 TN measurement values after controlling amount of added methanol

### **Benetits**

Using the Shimadzu On-Line Total Nitrogen Analyzer, the following results are achieved:

- Feedback control is possible, and the amount of methanol added is optimized leading to a reduction in the amount used by 30 - 40%.
  This is a cost saving of approx. 500,000 yen/month;
- Reduction in cost of manual analysis;
- Maintenance of a satisfactory level of quality in the discharged water;
- Data proving level of water quality is automatically preserved;
- · Abnormal water quality can be immediately dealt with.

## Applications of the TN Analyzer

- Controlling nitrogen removal processing (the current application)
- · Surveillance of discharged water
- Self-management of TN concentration regulation
- Improvement in accuracy control of measurements and surveillance according to ISO14001 environmental management systems

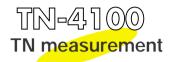
## Features when using TN-4100/TOCN-4100

- The TN-4100 allows auto-switching of up to six flow paths.
- Management of any points between source water and the final discharged water is possible, because of the auto-switching function that allows measurements of flow paths with widely variable TN concentrations.
- The TOCN-4100 enables simultaneous measurements of TN and TOC, widening the range of applications in monitoring and control. (The TOCN-4100 allows a maximum of three flow path switches.)
- e.g. Monitoring of the amount of organics (TOC) prior to nitrification

# Rapid and accurate measurement of total organics and total nitrogen in water

# Shimadzu On-Line Water Quality Analyzer

4100 Series











### SHIMADZU CORPORATION, International Marketing Division

3. Kanda-Nishikicho 1-chome, Chiyoda-ku, Tokyo 101-8448, Japan Phone: 81(3)3219-5641 Fax. 81(3)3219-5710 Cable Add.:SHIMADZU TOKYO

### SHIMADZU SCIENTIFIC INSTRUMENTS, INC.

7102 Riverwood Drive, Columbia, Maryland 21046, U.S.A. Phone: 1(410)381-1227 Fax. 1(410)381-1222 Toll Free: 1(800)477-1227

#### SHIMADZU DEUTSCHLAND GmbH

Albert-Hahn-Strasse 6-10, D-47269 Duisburg, F.R. Germany Phone: 49(203)7687-0 Fax. 49(203)766625 SHIMADZU (ASIA PACIFIC) PTE LTD.

16 Science Park Drive #01-01 Singapore Science Park, Singapore 118227, Republic of Singapore Phone: 65-778 6280 Fax. 65-779 2935

### SHIMADZU SCIENTIFIC INSTRUMENTS (OCEANIA) PTY. LTD.

Units F, 10-16 South Street Rydalmere N.S.W. 2116, Australia Phone: 61(2)9684-4200 Fax. 61(2)9684-4055

### SHIMADZU DO BRASIL COMERCIO LTDA.

Rua Cenno Sbrighi, 25, Agua Branca, Sao Paulo, CEP 05036-010, BRAZIL Phone: (55)11-3611-1688 Fax. (55)11-3611-2209

### SHIMADZU (HONG KONG) LIMITED

Suite 1028 Ocean Center, Harbour City, Tsim Sha Tsui, Kowloon HONG KONG Phone: (852)2375-4979 Fax. (852)2199-7438

#### Overseas Offices

Istanbul, Beijing, Shanghai, Guangzhou, Shenyang, Chengdu, Moscow

URL http://www.shimadzu.com