

## Study on the ultraviolet disinfection process of sewage treatment

Whole term

1994. 6 ~ 1996. 3

### (Purpose)

From 1993 to 1995, Aichi Prefecture, Japan and the Japan Institute of Wastewater Engineering Technology had had a joint research to investigate the safety of the ultraviolet disinfection and to establish a management policy for the Yahagi River Purification Center in Aichi Prefecture.

### (Results)

#### 1. Improvement of the facilities

A plate for prevention of short-cut at the bottom and a light shield for prevention of algae generation and photo-reefaction in the disinfection tank were installed, and it led to good results.

#### 2. Conventional water quality (13 items) and by-products (16 items)

- No change or formation due to the ultraviolet light was observed in every item.
- Because the correlation between the ultraviolet transmittance and  $COD_{Mn}$  was observed (correlation coefficient  $r = 0.775$ ,  $n = 113$ ),  $COD_{Mn}$  increased resulting in decrease of the ultraviolet transmittance and thus decreased the disinfection efficiency.
- The ultraviolet disinfection had a great influence on the effect of disinfection because of the presence of SS in the treated water. Therefore, an advanced treatment such as sand filtration is suggested for more effective disinfection.

#### 3. Effect of disinfection

- The water quality limit of the Yahagi River which is 300 coli/mL was almost achieved by the ultraviolet disinfection with an efficiency of 99%.
- The phage number of coliform after ultraviolet disinfection was lower than that of comparatively clean streams in urban areas.

#### 4. Mutagenicity

The results of both *rec*-Assay test and *umu*-test were negative.

#### 5. Influence on aquatic plants

- The result of *Susabinori*'s (Japanese laver's) breeding experiment using ultraviolet-disinfected treated water showed that the germination ratio increased as the amount of treated water addition increased. The number of survivals did not show a remarkable change.
- The ultraviolet disinfection had no impact on the water quality and did not generate by-products, especially chloramines and as well as that the influence on the aquatic plants was considered small.

#### 6. Photo-reefaction test

- The photo-reefaction ratio obtained from the experiment was almost the same as the normal value.
- If the treated water had been placed in a darkroom for 20 minutes immediately after the ultraviolet disinfection, photo-reefaction could have been prevented.
- This experiment with a target of 99% of disinfection indicated that 0.3 % of light recovery ratio can influence the disinfection ratio. Thus the light recovery should be prevented.

#### 7. Investigation on the short-circuiting flow

- It was discovered that the disinfection effect became worse under the disinfection-lamp because of a short-circuiting flow which did not receive the ultraviolet light generated.
- The number of germs in the downstream of the disinfection-lamp increased even after the installation of a short-circuiting flow-preventive plate as a result of the light recovery due to the disinfection-lamp.

#### 8. Disinfection-lamp

The relative intensity of illusion after 1-year operation against a new product was over 80%.

The product quality did not show consistency.

9. Contamination of the protective pipe of the disinfection-lamp

- The primary components of the adherent scale were aluminum, phosphorus and etc.
- The cleaning of the protective pipe of the disinfection lamp of Yahagi River Purification Center was performed every year.

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Keywords

Ultraviolet, Ultraviolet disinfection, Disinfection effect, Disinfection lamp, Photo-reactivation phenomenon, Laver