

Investigation on the efficiency of nitrogen and phosphorus removal by anaerobic-anoxic-oxic process using media

Whole term

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(Purpose)

In Tokyo Bay area, red tide and blue tide resulting in eutrophication occur every year in spite of the various efforts to improve the water environments. Kawasaki City officially approved the advanced treatment of wastewater for nitrogen and phosphorus removal in March 1996 and promoted the introduction to every treatment plant one of which was Asoh Treatment Center that employed the “ anaerobic-anoxic-oxic process using media” for efficient land-use and reconstruction of the existing facilities.

In this research, treatment performance of the advanced treatment process of Asoh Treatment Plant and the relationship between the operational factors and the treatment efficiency were evaluated and then the design resources and the manual for the operation were summarized.

(Results)

The results from the investigation of the operational conditions before the introduction of this process and the experiments from Run1 to Run4 to evaluate the treatment performance were as follows:

- 1) For the case of the daily maximum wastewater inflow rate, the total average value ranging from 15.7% to 17% showed no problem though the flow of media concentration in the aeration tank tended to incline towards the downstream.
- 2) In accordance with the media separating experiment of the screen using treated wastewater, the sign of screen blocking was not observed with any changes of the condition related to aeration before or after screening, the operation of the underwater aerator in the aeration tank and etc. However, the screen blocking could happen with respect to the experimental conditions of activated sludge mixed liquor, thus a proper aeration intensity before screening and a regular screen cleaning (once in several months) would be required to secure the stable screen separation.
- 3) As per the K_{La} measurement of the underwater aerator of this process, the oxygen transfer efficiency in clean water was calculated to be approximately 40%, which was as high as twice that of the existing process.
- 4) The performance of the process for the operation of daily maximum wastewater inflow rate was fine as well satisfying the targeted treated wastewater quality.
- 5) MLSS concentration was determined as 1,300 mg/L for the period of high water temperature and the performance was good.
- 6) For the case in which the DO of the aeration tank was made below 1 mg/L by doubling the ventilation rate, 1~2 mg/L of NH_4-N left at the exit of the aeration tank, however the denitrification at anoxic tank was enough to make T-N of the treated water the same as that in the case of thrice the ventilation rate.
- 7) As a result of two different cases of circulating discharge of 150% (corresponding to the current inflow water quality) and 300% (expecting 50 mg/L of inflow nitrogen concentration), the nitrogen removal performance of both the cases were up to the satisfaction of the targeted quality.
- 8) The denitrification reaction rate in anoxic tank for the circulating discharge of 300 % was 84 percent of that for the circulating discharge of 150%.
- 9) The contribution of media increased as the water temperature decreased.
- 10) As a result of phosphorus removal due to rainfall, it was verified that the phosphorus released from the anaerobic tank was small.
- 11) In this research, the simulation model using media based on the activated sludge model (ASM2d) of IWA for operation was investigated and the simulated condition for a proper

treatment-performance was confirmed.

The result of this research was applied to the establishment of design resources and an operational manual of the anaerobic-anoxic-oxic method using media.

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Keywords

Simultaneous removal of nitrogen and phosphorus, Use of media, A²O process