

Joint research on the development of a high efficient nitrogen and phosphorus- removing process for the Kasumigaura Region Sewerage system

Whole term

1995. 10 ~ 2000. 3

(Purpose)

The objective of this research was to evaluate, by using a pilot plant, the applicability of the high efficient nitrogen and phosphorus-removing process using media (modified Bardenpho process) as one of the high efficient nitrogen and phosphorus-removing process applicable to Kasumigaura Purification Center, and to establish a set of suitable targeted water quality characteristics and a treatment process. This research had been performed for 5 years from 1995 to 1999 in subsequent events such as the examination of the targeted water quality, treatment process and design conditions in 1995; the design and construction of the pilot plant in 1996; and the experiments in 1997 and 1998. In 1999, the design and operational conditions based on the results from the pilot plant were investigated, preceding an integrated evaluation of this process through a sample design and evaluation on the actual applicability to Kasumigaura Purification Center.

The summary of the pilot plant experiments and the result of the investigation on the applicability are presented in this report. This joint research was performed in collaboration with the Kasumigaura Regional Sewerage Office, Ibaraki Prefecture.

(Results)

1) Summary of the pilot plant experiments

① T-N exceeded the targeted value during the entire research period despite the adverse conditions such as short HRT created purposely in several cases, thus it could be concluded that the process could reach the targeted water quality. It was observed that it could guarantee the targeted quality for 10~12 h of HRT.

② As an evaluation of the nitrification process, the approximate equation between the water temperature and the nitrification rate constant of the mixed liquor of the nitrified media and MLSS could be obtained from the regression method.

③ As an evaluation of the denitrification process, the approximated equation between the water temperature and the denitrification rate constant could be obtained using BOD-SS load by methanol addition.

④ According to the evaluation of the phosphorus removal process, phosphorus uptake rate was influenced by the releasing rate. An HRT of more than 1 h in the anaerobic tank was recommended for a favorable phosphorus release.

2) Investigation on the model design and the actual application.

The processes investigated as a model design were in 6 cases: 3 cases associated with the aforementioned treatment system (high efficient nitrogen and phosphorus-removing process) with changes of HRT, 2 cases associated with the anaerobic-Anoxic-Oxic process and flocculant-added circulating nitrification denitrification process currently used in Kasumigaura Purification Center and the other case associated with flocculants-added nitrification endogenous denitrification method was used as a comparison. From this integrated evaluation, the case associated with this process (high efficient nitrogen and phosphorus-removing process) with HRT equal to 12.9 h and methanol addition in winter was the most economical method and the most efficient in land use. It was the optimal for the targeted quality achievement in the pilot plant experiments.

(Future plan)

Although these pilot plant experiments and the evaluation of applicability to actual condition conducted in 1997~1999 gave considerable amount of information on the utilization of this process and technology; the adaptability and the efficiency of media used in the real biological reactor, and

problems associated with maintenance (especially, screen for media used) should be investigated on larger scale. Future experiments of real-size are expected.

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Keywords

High efficient nitrogen and phosphorous removing process, Pilot plant,
Media, Modified Bardenpho process