Research on the utilization of the advanced treatment technology with a deep reactor in which a medium is used		
Whole term	1998. 5 ~ 2000. 3	

(Purpose)

This method removes nitrogen and organic matter represented by BOD at the same time, without changing the fundamental structure and volume of the existing deep reactor. For two years from 1998, a real-scale experiment for utilization was performed to verify the applicability to the circulating nitrification-denitrification process in the advanced treatment unit of the Otsu treatment plant (belongs to the category that flocculants are added), in which there was a fixed-bed medium to some height of the deep reactor to promote nitrification.

For the treatment flow of this experiment, the existing deep reactor was divided into 4 parts as the 1st and 2nd being with no oxygen and being micro-aerobic, respectively and both the 3rd and 4th being used for aeration. In the aeration tank, a packing volume of 3.0 V/V% (apparent volume 12%) of fixed bed media was filled. The fixed bed medium was of the shape of a cylinder having an inner radius of 3 mm, outer radius of 4 mm and length of 5 mm and was made of polypropylene.

Targeted treated water quality (mg/L)	
BOD	Less than10
COD	Less than 10
SS	Less than 10
T-N	Less than 10
T-P	Less than 0.5

The contents for investigation were; 1) the treatment capacity by continuous real-scale experiment; 2) nitrification and denitrification performance; 3) uniform dispersion of media in the deep aeration tank; 4) maintenance and economy; and 5) design resources.

(Results)

(1) The treated wastewater quality satisfied the targeted quality in all conditions tested (HRT=5.2~6.6 h, R=1.5~2.3). In addition, T-N removal rate was over 75%, and this rate {R/ (1+R) x100)} was higher by 10% or more than that estimated from the circulation ratio (R).

(2) One of the reasons for higher T-N removal rate than that estimated from the circulation ratio for all the conditions was the reduction of soluble T-N in the non aeration tank. According to DO and ORP distribution of the tank, aerobic zone formed in the upper part and the anaerobic zone was in the lower part. The nitrification and denitrification reactions occurred at the same time, which might have caused T-N removal rate to be higher than the estimated value.

(3) The average nitrification speed per unit media volume with the water temperature at 15° C was 120 mg-N/L-media/h, and the average nitrification speed constant of the activated sludge was 2.2 mg-N/g-SS/h. The nitrification capacity of the activated sludge remained constant despite the fact that A-SRT for water temperature at 15° C reduced to 3~5 days.

(4) The efficiency of oxygen dissolution was approximately 14 % in the aeration tank of the 10-year-plate aerator.

(5) From the examination of the distribution of the media concentration in the aeration tank, the media fluctuated well in the tank in almost a uniform pattern. Also, the pattern did not change for the media used for 4 years continuously, confirming the long-term stability.

(6) The design resources including the characteristics of the non aeration tank were investigated and summarized as the design and operation and maintenance manual for Otsu Treatment Center.

(7) The comparison between the anaerobic-non aeration-aeration method using media of this system, and the existing circulating nitrification-denitrification method using media, proved that this system is economically more beneficial.

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