

**Research on anaerobic-anoxic-oxic process using media with internal recycling  
(nitrate recycling)**

Whole term

2000.7~2003.9

**(Purpose)**

At Osaka Bay where the water treatment center called “ Muko River Downstream ” discharges treated wastewater to, the water quality standards for T-N and T-P have been established in order to prevent eutrophication since the area seemed a potential candidate for eutrophication. In order to produce an all-out plan for the treatment of wastewater in the Osaka Bay area which seemed at high risk of getting polluted, the targeted wastewater quality level for BOD, COD, T-N and T-P were set as 5mg/L, 11mg/L, 7mg/L and 0.6mg/L, respectively.

This treatment center uses the conventional activated sludge process. However, the necessity of advanced wastewater treatment was highlighted. Biological treatment using media has higher nitrification and denitrification rates than the advanced treatment with activated sludge alone.

And there was no need of an extra site to adopt an advanced wastewater treatment unit. Accordingly, a pilot plant was run to estimate the performance.

**(Results)**

Data from a pilot scale conventional activated sludge process with a flow rate of 18,500m<sup>3</sup>/day were as follows:

1) Performance of the wastewater treatment

Targeted water quality was satisfied by an advanced treatment with a HRT of 7 h.

2) Calculation of the volume

- The nitrification and denitrification rates were reviewed.

Even though the nitrification rate was larger than the earlier designed value, the safety factor was not changed. The denitrification rate had been changed because of the lower design value.

- The safety factor included undefined nitrification in the inner part of the media.
- NO<sub>x</sub>-N loading to the anoxic tank excluded NO<sub>x</sub>-N loading from the return sludge.
- An additional wall in the bioreactor made this method possible to be used. The surface loading to the preliminary and the secondary settling tank did not change.

3) Maintenance

- There was no special arrangement to maintain the media.

4) Cost

- Rebuilding an advanced treatment makes the electric power cost 2.4 times more than that of the conventional activated sludge (1.22 yen/m<sup>3</sup>-sewage)
- According to the results of the abrasion test and the actual results obtained in the abroad, the media can be approximated for the last fifteen years.

5) Example for the calculation of the application range

- The application range was calculated upon some assumptions. The influent concentration of T-N correlated with the HRT and the effluent concentration of T-N.
- For example, 40 mg/L of input T-N reduced to 8.3 mg/L in the output within a HRT of 8.5 h.

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Keywords

Advanced treatment, Removal of nitrogen and phosphorus, Circulating media, A<sup>2</sup>O process, Economical efficiency