

## Study on propeller type underwater mixer with swivel mechanism

Whole term

2003.6 ~ 2005.3

### ( Purpose )

The underwater mixer type aeration apparatus (aerator) is widely adopted for mixing of anaerobic tank and anoxic tank.

However, the reduction of the number of apparatus, required mixing power, mass of apparatus are strongly required. The propeller type underwater mixer with swivel mechanism, which is the subject of present study, is the light weight mixer with swivel mechanism for mixing of anaerobic tank and anoxic tank, and less required mixing power and smaller size of apparatus than that of existing models are expected.

As the results of this study, required input mixing power density could be determined according to the dimensions of the rectangular reacting tank and the installed position of mixer based on the database which is established by CFD simulation validated by the actual tank mixing test data. The purpose of present study is to organize the technical informations using completed design methodology which clarify the characteristics, features, economical efficiency, maintenance and management characteristics of this apparatus.

### ( Technical outline )

The configuration of this apparatus is shown in Figure 1, and the mixing image is shown in Figure 2. The underwater mixer is located at the bottom of the tank during operation, and it can be easily installed or removed by hoisting using the hoist pole as a guide. The turning of underwater mixer is implemented by rotating the swivel pole by turning drive unit. The driving power of turning drive unit is fixed at 0.2kW not depending on the tank size.

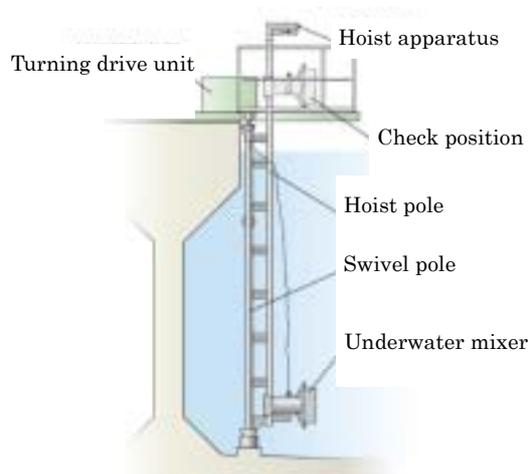


Figure 1. Configuration of underwater mixer

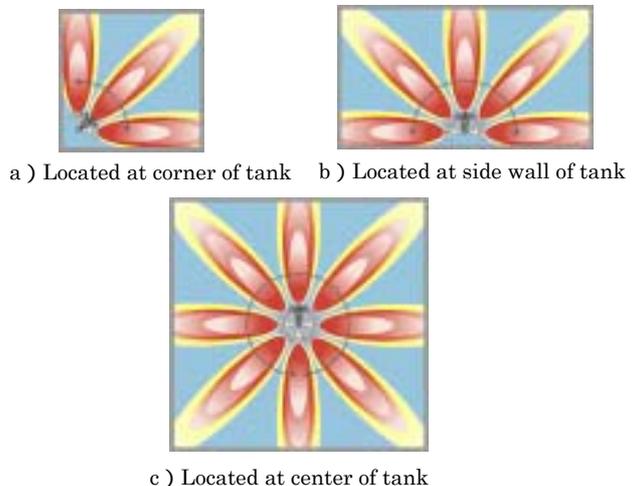


Figure 2. Mixing image

### ( Result )

The required input mixing power density for each located position, which is determined by the actual tank tests, and CFD simulations is shown in Tables 1 and 2. The range of required input mixing power density is 3.0 to 6.0W/m<sup>3</sup>, and the required power could be reduced by about 50% compared to the underwater mixer type aeration apparatus (6.0 ~ 10W/m<sup>3</sup>).

The technical informations references are complete organizing the knowledge obtained in present study.

Table 1. Required input mixing power density ( $W/m^3$ ) at the side wall part or corner part

Fineness ratio	1:1.2 or less*1	1:1.5 or less*1	1:4 or less
Water depth 5m	3.5	4.0	5.0
Water depth 10m	3.0	3.5	4.0

\*1 is located at corner part, others are located at side wall part

Table 2. Required input mixing power density ( $W/m^3$ ) at the center part

Fineness ratio	1:1.2 or less	1:1.5 or less	1:4 or less
Water depth 5m	3.5	4.5	6.0*2
Water depth 10m	3.5	4.0	5.0

\*2: For water depth 5m, fineness ratio is less than 1:4, the length of tank should be 32m or less

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key words

Propeller type underwater mixer with swivel mechanism , underwater mixer type aeration apparatus , reduction of the required mixing power