Oxygen Utilization Rate (OUR) Estimation

Oxygen Utilization Rate OUR = Oxygen Utilized/Oxygen Supplied.

In most cases, it is difficult to obtain data on the total oxygen utilized, so there is a tendency to approximate the oxygen utilization rate using the following equation (2):

OUR = calculated oxygen demand/oxygen supplied

The results calculated using Eq. (2) are accurate only if the DO is 2mg/L, otherwise the oxygen transfer efficiency is either underestimated (at DO > 2mg/L) or overestimated (at DO < 2mg/L).

$$AOTR=(\alpha\cdot SOTR\cdot\theta/Cs20)\times(\tau\cdot\Omega\cdot\beta\cdot Cs20-COP)$$

$$Cst=\tau\cdot\Omega\cdot\beta\cdot Cs20$$

Assuming all other factors are the same as at design, the actual oxygen transfer efficiency (AOTR) depends only on the magnitude of the (CS20-COP) value. The larger the COP value, the smaller the actual oxygen transfer efficiency AOTR value. Aerator manufacturers usually set the OUR design point at COP=2mg/L. Therefore, when the COP is above or below 2mg/L, it is not surprising that the value calculated by Equation (2) deviates from the data provided by the manufacturer.

In order to better assess the OUR, the following three steps are recommended:

1. Measure and record the DO value, along with the corresponding time period;
2. Obtain the weighted average of the DO as the COP value;
3. Correct the data obtained from the calculation of Equation (2) using the weighted average COP and Equation (3)

OUR* = (Calculated Oxygen Demand/Supply Oxygen Demand) * （τ·Ω·β·CS20-2） / （τ·Ω·β·CS20-COP）

Example:

Assuming τ, Ω, and β are all 1, CS20 = 9.08, weighted average of DO = COP = 3.8, and (Calculation of Oxygen Demand / Oxygen Supply) =70%

OUR* = 70% * (9.08-2) / (9.08-3.8) = 93.86%
OUR* - is the true oxygen utilization rate

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