

Example A1. 2

In a 10 litre reactor with an absorption constant of $k_{\text{abs}} = 0.39 \text{ h}^{-1}$ and receiving 20 l.d^{-1} influent (dissolved oxygen = $1.0 \text{ mg O}_2.\text{l}^{-1}$ and 10 l.d^{-1} return sludge (dissolved oxygen = $0.4 \text{ mg O}_2.\text{l}^{-1}$), the aeration is interrupted and it is observed that the dissolved oxygen concentration decreases from 5 to $3 \text{ mg O}_2.\text{l}^{-1}$ in 320 seconds. Determine the apparent OUR and the value corrected for the hydraulic effect and the absorption of oxygen.

Solution:

The value of the apparent OUR is calculated as:

$$\text{OUR}_a = (\text{DO}_1 - \text{DO}_2)/(\text{t}_2 - \text{t}_1) = (5 - 3)/320 = 22.5 \text{ mg O}_2.\text{l}^{-1}.\text{h}^{-1}$$

The hydraulic effect was determined in Example A1.1 for the average dissolved oxygen concentration of $4 \text{ mg O}_2.\text{l}^{-1}$ in the reactor:

$$\text{OUR}_h = 0.8 \text{ mg O}_2.\text{l}^{-1}.\text{h}^{-1}$$

The OUR effect of the absorption of oxygen can be calculated for $k_{\text{abs}} = 0.39 \text{ h}^{-1}$ and the average dissolved oxygen concentration of 4 mg.l^{-1} in the reactor:

$$\text{OUR}_{\text{abs}} = 0.39 \cdot (7.7 - 4) = 1.44 \text{ mg O}_2.\text{l}^{-1}.\text{h}^{-1}$$

Hence the OUR due to metabolism in the reactor can now be calculated as:

$$\text{OUR} = \text{OUR}_a - (\text{DO}_i - \text{DO})/R_h + k_{\text{abs}} \cdot (\text{DO}_s - \text{DO}) = 22.5 - 0.8 + 1.4 = 23.1 \text{ mg O}_2.\text{l}^{-1}.\text{h}^{-1}$$

It is concluded that under the specified conditions the apparent OUR value ($22.5 \text{ mg O}_2.\text{l}^{-1}.\text{h}^{-1}$) is virtually identical to the OUR due to metabolism ($23.1 \text{ mg O}_2.\text{l}^{-1}.\text{h}^{-1}$).