Example A1.1

Determine the hydraulic effect in a 10 litre reactor receiving 20 $l.d^{-1}$ of influent (DO = 1 mg $O_2.l^{-1}$) and 10 $l.d^{-1}$ of return sludge (DO = 0.4 mg $O_2.l^{-1}$), if a dissolved oxygen concentration of 4 mg $O_2.l^{-1}$ is maintained in the reactor.

Solution:

First the weighted average of dissolved oxygen in the inlet (influent + return sludge) is calculated as:

$DO_i = (20 \cdot 1 + 10 \cdot 0.4)/(20+10) = 24/30 = 0.8$ mg $O_2.l^{-1}$

Now Eq. (A1.2) is applied:

$OUR_h = (dDO/dt)_h = (DO_e - DO_i)/R_h = (4 - 0.8)/(10/30) = 9.6$ mg $O_2.l^{-1}.d^{-1} = 0.4$ mg $O_2.l^{-1}.h^{-1}$.

It is concluded that the dissolved oxygen concentration in the reactor decreases at a rate of 0.4 mg $O_2.l^{-1}.h^{-1}$ due to the hydraulic effect, independent of any biological oxygen consumption. In most cases the hydraulic effect is very small compared to the OUR for metabolism. However, when the biological OUR is low, for example in aerated lagoons, correction for the hydraulic effect may be important.