Example 6.3

A settler with a diameter of 20 m is fed with a mixed liquor flow of 300 $m^3.h^{-1}$, containing a sludge concentration of 6 $g.l^{-1}$. The Vesilind constants are k = 0.4 $l.g^{-1}$ and v_0 = 8 $m.h^{-1}$, while a recirculation factor s = 1 is being applied. Demonstrate that the settler is underloaded.

Solution:

For X_t = 6 $g.l^{-1}$ and s = 1 one has $X_r = X_t \cdot (s+1)/s = 6 \cdot 2 = 12$ g TSS.l^{-1}

$X_l = (X_r/2) \cdot [1 + (1 - 4/(k \cdot X_r))^{0.5}] = 12/2 \cdot [1 + (1 - 4/(0.4 \cdot 12))^{0.5}] = 8.4$ g TSS.l^{-1}

The limiting flux is given by:

$F_l = X_r \cdot v_o \cdot (k \cdot X_l - 1) \cdot \exp(-k \cdot X_l) = 12 \cdot 8 \cdot (0.4 \cdot 8.4 - 1) \cdot \exp(-0.4 \cdot 8.4) = 7.9$ kg TSS.$m^{-2}.h^{-1}$

The applied solids loading rate is:

$F_{sol} = (s + 1) \cdot X_t \cdot Q_i/A = 300 \cdot 6/314 = 5.7$ kg TSS.$m^{-2}.h^{-1}$.

It is clear that the applied solids loading rate (5.7 kg TSS.$m^{-2}.h^{-1}$) is significantly less than the limiting flux (7.9 kg TSS.$m^{-2}.h^{-1}$). Therefore the setter is not receiving the maximum solids loading rate.