

Example 6.1

Using stirred batch cylinders it is attempted to determine the Vesilind settleability constants for a certain sludge. The height of the solid-liquid interface has been measured for 6 different sludge concentrations as a function of time for 30 minutes. The results are shown in Table 6.1 below. Determine the values of k and v_0

Solution:

To determine the values of the settleability constants follow the procedure as described above:

- (1) Plot the position of the interface as a function of time at different concentrations. Fig. 6.2 shows the data points and associated curves (dotted lines);
- (2) Decide which part of the curve may be considered as linear. In Table 6.1 these data points are marked in "bold";
- (3) Draw the best-fit straight line through the linear part of each curve. These straight lines are indicated in Fig. 6.2;
- (4) Determine the zone settling velocity (ZSV) as the gradient ($\Delta Y/ \Delta X$) of the straight lines. The values are indicated in Fig. 6.2;
- (5) Plot the values of $\ln(\text{ZSV})$ as a function of the sludge concentration as demonstrated in Fig. 6.3 and draw the best-fit straight line through the data points;
- (6) Use Fig. 6.3 to determine the value of the constants: k is equal to the gradient of the straight line ($\Delta Y/ \Delta X$) and v_0 is equal to the intersection of the straight line with the vertical axis. In this example $k = 0.44 \text{ l}\cdot\text{g}^{-1}$ and $v_0 = \exp(2.96) = 19.2 \text{ cm}\cdot\text{min}^{-1} = 6.9 \text{ m}\cdot\text{h}^{-1}$.

Table 6.1 Level of solids-liquid interface (in cm under the liquid surface) as a function of time for different sludge concentrations

Time (min)	Sludge concentration (g TSS·l ⁻¹)					
	$X_t = 1.2$	$X_t = 2.0$	$X_t = 3.1$	$X_t = 3.9$	$X_t = 4.9$	$X_t = 6.2$
0	0	0	0	0	0	0
1	-4.5	-3.5	-2.5	-2	-1.5	-0.5
2	-9.5	-9.5	-6	-5	-3	-2
3	-20	-19	-11.5	-8.5	-5.5	-3.5
4	-31.5	-27	-17	-12	-8	-5
6	-54	-42.5	-27.5	-19.5	-13.5	-7.5
8	-63.5	-59.5	-38	-26.5	-19	-10
10	-71	-68	-49.5	-33.5	-23	-12
12	-76	-71	-57.5	-43.5	-28.5	-14
15	-82	-75.5	-65.5	-54	-35	-18
20	-85	-79	-71	-64.5	-48	-25.5
25	-86.5	-81	-73.5	-69	-57.5	-30.5
30	-87.5	-83.5	-76	-72.5	-61	-37

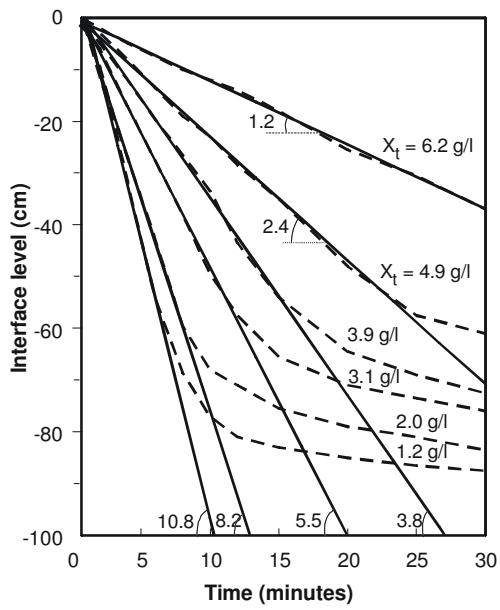


Figure 6.2
Graphical representation of the data in Table 6.1

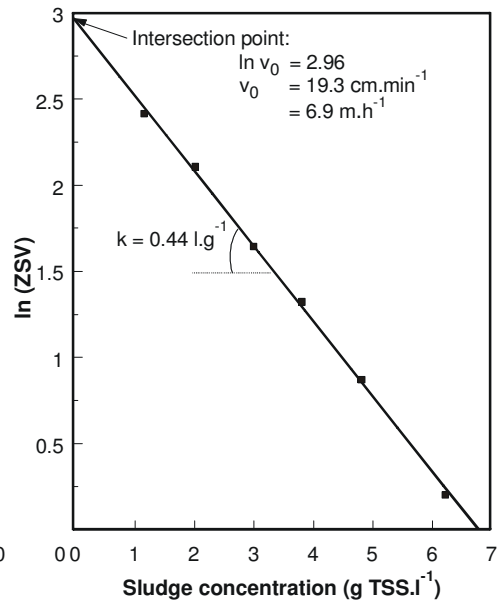


Figure 6.3
Semi log diagram of the zone settling velocity versus the sludge concentration based on the data in Table 6.1