For discrete particles within a given settling velocity range, the following expression may be used

$$\text{Total fraction removed} = \frac{\sum_{i=1}^{n} \frac{v_{n_i}}{v_c}(n_i)}{\sum_{i=1}^{n} n_i} \tag{5-30}$$

where v_n = average velocity of particles in the ith velocity range
n_i = number of particles in the ith velocity range

The use of Eq. (5–30) is illustrated in Example 5–6.

EXAMPLE 5–6 Calculation of Removal Efficiency for a Primary Sedimentation Basin Determine the removal efficiency for a sedimentation basin with a critical overflow velocity of 2 $m^3/m^2 \cdot h$ in treating a wastewater containing particles whose settling velocities are distributed as given in the table below. Plot the particle histogram for the influent and effluent wastewater.

Settling velocity, m/h	Number of particles per liter × 10^{-5}
0.0–0.5	30
0.5–1.0	50
1.0–1.5	90
1.5–2.0	110
2.0–2.5	100
2.5–3.0	70
3.0–3.5	30
3.5–4.0	20
Total	500

Solution

1. Create a table for calculating the percentage removal for each particle size. Enter the particle settling velocity ranges in column (1).

Settling velocity range, m/h (1)	Average settling velocity, m/h (2)	Number of particles in influent, × 10^{-5} (3)	Fraction of particles removed (4)	Number of particles removed, × 10^{-5} (5)	Particles remaining in effluent, × 10^{-5} (6)
0.0–0.5	0.25	30	0.125	3.75	26.25
0.5–1.0	0.75	50	0.375	18.75	31.25

(continued)