Sedimentation Example 1

- Estimate the settling velocity of sand (ρ_p = 2,650 kg/m^3) with a mean particle diameter of 0.21 mm.
- Assume the sand is approximately spherical.
- Using a safety factor of 1.4 to account for inlet and outlet losses, estimate the area required for a chamber to remove the sand if the flowrate is 0.10 m^3/sec (1,000 *liters* = 1 m^3).

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The density of water at 20^{0}C is 998 kg/m^3 and the viscosity of water at 20^{0}C is 1.01(10^{-3}) $N\text{-}s/m^2$ (Newton = $kg\text{-}m/s^2$). The Stokes settling velocity is:

$$v_p = v_s = OFR = \frac{(\rho_p - \rho_w)d^2 g}{18\mu}$$

$$= \frac{\left(2650\frac{kg}{m^3} - 998\frac{kg}{m^3}\right)\left(2.1\times10^{-4}m\right)^2\left(9.81\frac{m}{s^2}\right)}{18\left(1.01\times10^{-3}\frac{kg}{ms}\right)}$$

= **0.039 *m/s* = 3.9 *cm/s***

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Knowing the overflow rate, the area required is:

$$A = \frac{Q}{OFR}(SF) = \frac{0.10\,m^3/s}{0.039\,m/s}(1.4) = 3.6m^2$$

where ***SF*** is the safety factor, 1.4