# Flocculation Equations


Bernoulli and Navier Stokes Equations | Control Volume Equations | Dimensional Analysis Equations | Equations | Flocculation Equations
Flow Measurement Equations | Open Channel Flow Equations | Pipe Flow Equations | Process Controller equations | Sedimentation Equations
Statics Equations | Using Confluence - Tips and Tricks


Relationship between velocity gradient and energy dissipation rate

$$G = \sqrt{\frac{\varepsilon}{\nu}}$$

Relationship between velocity gradient and energy loss based on a change in the pressure coefficient. Note that the pressure coefficient here is equivalent to a minor loss coefficient.

$$\varepsilon = C_P \frac{V^2}{2\theta}$$

Energy dissipation estimate for a cell located just downstream from the 180 degree bend in a flocculator.

$$\varepsilon_{cell} = \frac{1}{b}\left(\frac{Q}{wb}\right)^3 \frac{C_P}{2H_{cell}}$$

Gcell for hydraulic flocculator

$$G_{cell} = \frac{1}{b^2}\left(\frac{Q}{w}\right)^{\frac{3}{2}} \sqrt{\frac{K_{180}}{2\nu H_{cell}}}$$

G $_{cell}$ for hydraulic flocculator

$$G\theta_{cell} = \sqrt{\frac{H_{cell} Q K_{180}}{2\nu w}}$$

Floc Baffle Spacing

$$b = \left(\frac{1}{G_{cell}}\right)^{\frac{1}{2}} \left(\frac{Q}{w}\right)^{\frac{3}{4}} \left(\frac{K_{cell}}{2\nu H_{cell}}\right)^{\frac{1}{4}}$$

Shear (Velocity Gradient)

$$\tau = \mu \frac{du}{dy}$$

Relationship between G and Head loss

$$\bar{G} = \sqrt{\frac{g h_l}{\nu \theta}}$$

Suspension Turbidity $T = 0.3279 \times C_{clay} - 2.0839$ Alum Dose $D = (1 + \log_{10} T) \times 15$ Alum Flowrate

$$Q_{alum} = \frac{D \times Q_{plant}}{C_{alum}}$$

G average (per baffle)

$$\overline{G}_{baffle} = \sqrt{\frac{g \cdot h_l \cdot Q}{\nu \cdot h \cdot w \cdot b}}$$

$$G_{max} = \left(\frac{Q}{w \cdot b}\right)^{\frac{3}{2}} \sqrt{\frac{K}{2 \cdot \nu \cdot b}}$$

Maximum shear allowed

$$G_{max,design} \approx \frac{1}{d_{floc}} \sqrt{\frac{8 \cdot \tau_{floc}}{C_D \cdot \rho_w}}$$

$$\theta_{baffle} = \frac{w \cdot h \cdot b}{Q}$$

Degree of Flocculator Mixing

$$G\theta = \sum_i \overline{G}_{baffle,i} \cdot \theta_{baffle,i}$$

Height of water as flocculators drain

$$h_{new} = h_{previous} + \frac{(Q_{outflow} - Q_{inflow}) * \Delta t}{base * width}$$

Force on baffle during tank draining

$$Force_i = \left(\frac{1}{2}\rho g w_{baffle}\right) \cdot \left[h_i^2 - h_{i+1}^2\right]$$

ratio between baffle spacing and height of horizontal channel above or below a baffle (to avoid short circuiting when b is large)

$$f_{ratio} = \frac{h_{water} - overlap}{2b}$$

Number of baffles based on Gtheta

$$n_{baffle} = \frac{G\theta_{tank}}{G_{baffle}\theta_{baffle}}$$

headloss through a floc tank

$$headloss = n_{baffle}\frac{Kv^2}{2g}$$

Maximum flow rate our flocculators can deliver

$$Q_{max} = w \cdot \left(\frac{h}{2b_{ratio}}\right)^{\frac{1}{3}} \cdot G_{min}^{\frac{2}{3}} \cdot \left(\frac{2\nu\Pi_{vc}}{K}\right)^{\frac{1}{3}}$$

Floc baffle spacing - NOT BASED ON ACTIVE VOLUME

$$b = \frac{Q}{w} \cdot \left(\frac{K}{2G_{min}^2\nu h}\right)^{\frac{1}{3}}$$

Headloss (Only minor loss)

$$h_l = k \cdot \frac{v^2}{2g}$$