Carbon Dioxide Removal Problem

- Groundwater containing 20 mg/l of carbon dioxide is to be degasified using a series of six multiple-tray aerators. Each aerator uses eight trays. The aerators will be operated in parallel. For flexibility, any five aerators will be operative at one time while one aerators is inoperative for cleaning and maintenance.
- The design population is 40,000, and the maximum demand is 130 gal/person-day. The ***k*** value is 0.30, and the hydraulic loading is 3 gpm/ft.^{2}.
- Determine:
  - The carbon dioxide content of the product water.
  - The size of the trays if the length-to-width ratio is 1:1 and the trays are made in 1 in. increments.

$$\frac{C}{C_0} = e^{-kn}$$

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Carbon Dioxide Removal Problem

The performance equation is: $\frac{C}{C_0} = e^{-kn}$

Therefore:

$$C = C_0 e^{-kn}$$

$$C = 20\ e^{-8(0.30)}$$

8 aeration trays

20 mg/l initial concentration

C = 20 mg/l (0.0907) = **1.81 mg/l**

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Carbon Dioxide Removal Problem

The flow to each aerator is:

$$Q = 40{,}000\ persons \left[\frac{130 gal}{person - day}\right] = 5.2 \times 10^6\ gal/day$$

$$Q = \left[5.2 \times 10^6\ gal/day\right]\left[\frac{day}{1{,}440 \min}\right] = 3{,}611.1\ gal/\min$$

Total flowrate

# of aerators

$$Q = \left[3{,}611.1\ gal/\min\right]\left(\frac{1}{5}\right) = 722.2\ gal/\min$$

Flowrate/aerator

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Carbon Dioxide Removal Problem

The area is: $A = (722.2 gpm)\left[\frac{ft.^2}{3 gpm}\right] = 240.7\ ft.^2$

Flowrate/aerator

Loading rate

Since L = W, therefore:

A = W(W) = 240.7 ft.^{2}

W = 15.51 ft. or 15 ft. 6.19 in. or **15 ft 7 in**

L = W = 15.51 ft. or **15 ft. 7 in.**

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Treatment Processes

Any Questions?

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