

Scale up Design Calculation

A regeneration level of 125 NaCl/L has been selected using co-current regeneration. The equation below is has been obtained from the engineering Bullatin for Puralite A520E resin.

$$\text{Cyclic output (liters)} = \frac{V * OC}{L - L_n} \quad \text{where:}$$

V = Resin Volume (mL)
OC = Operating Capacity (eq/L)
L = Nitrate Load (meq/L)
Ln = Nitrate Leakage (meq/L)

$$\frac{\text{Nitrate}}{\text{Nitrate} + \text{Sulfate}} = \frac{NO_3^-}{NO_3^- + SO_4^{2-}} = \frac{5.525}{5.525 + 3.125} = 0.638728 \text{ for L output}$$

$$\frac{\text{Nitrate}}{\text{Nitrate} + \text{Sulfate}} = \frac{NO_3^-}{NO_3^- + SO_4^{2-}} = \frac{89.29}{89.29 + 156.5} = 0.631575 \text{ for Gal Output}$$

Figures 1 and 2 below are from the engineering bullatin provided by Purolite. Both figures are for Co-Current Regeneration. Co-Current Regeneration means that the regeneration flow will be in the to NO_3^- and SO_4^{2-} and concentration of regeneration solution. Figure 1 present the operating capacity as a function of the NO_3^- to NO_3^- and SO_4^{2-} and concentration of regeneration solution.

Figure 1 Operating Capacity

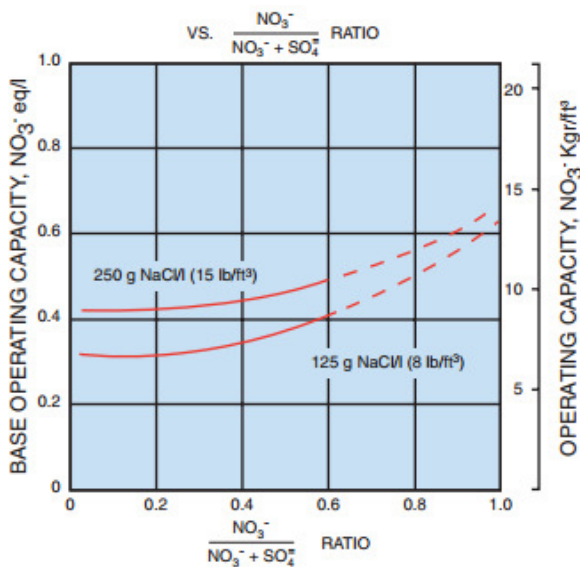
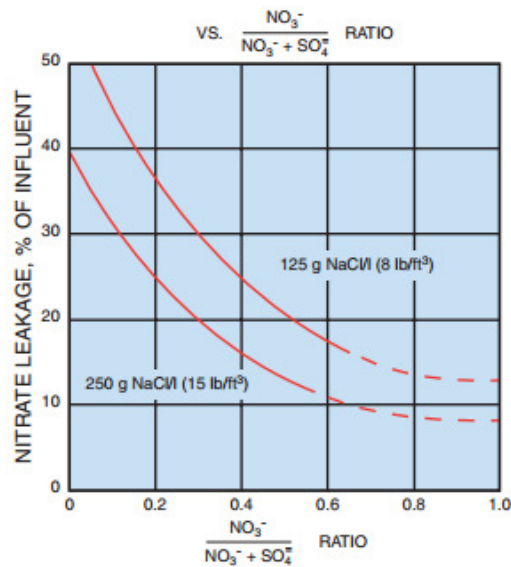


Figure 2: Nitrate Leakage



From Figure 2 the resulting nitrate leakage for a nitrate sulfate ratio of 0.639 and a regeneration concentration of 125 g NaCl/L is 16% leakage of nitrate in effluent.

Target cyclic output is 30 days at a flow rate of 0.2 gpm.

Monthly Cyclic output requirement= 8640 gallons

Cyclic output per cubic foot resin= 2902.427 gallons

Design factor= 0.85
2467.063 gallons designDesign requires= 3.502141 ft³ of resin 0.875**Column Sizing Option A**Diameter= 1 ft Cross Sectional Area= 0.785398 ft²required volume= 5.84 ft³
min Column Height= 7.43 ft
Resin Depth= 4.46 ft**Column Sizing Option B**Diameter= 1.5 ft Cross Sectional Area= 1.767146 ft²required volume= 5.84 ft³
min Column Height= 3.30 ft
Resin Depth= 1.98 ft**Volume of Brine Regeneration Liquid Required**

Select 4 Bed Volumes for Recharge

Volume= 104.784 Gallons of 8lb/ft³ NaCl Brine Solution

Therefore select 120 Gallon Regeneration tanks

Pressure Drop Estimation

The pressure drop has been calculated based on Figures 1 and 2 bellow

dPA max= 13.35 psi at 5° C
dPA min= 5.785 psi at 30° CdPB max= 3.96 psi at 5° C
dPB min= 1.386 psi at 30° C**Backwash Flow Rate**

Select 70% Bed Wash Expansion

Q_B A max= 0.024682 Gallon/min @ 5° C
Q_B A min= 0.04879 Gallon/min @ 50° C

Q_B B max= 0.055534 Gallon/min @ 5° C
Q_B B min= 0.109777 Gallon/min @ 50° C