

## Chapter 8

1. What is disadvantage of gas liquid chromatography?

Ans: Slow vaporization of stationary phase leading to change in column criteria, contaminates the product.

2. What is the common stationary phase in HPLC?

Ans: C<sub>8</sub> or C<sub>18</sub> compounds attached to silica gel.

3. What is a shockwave?

Ans: If a concentrated stream is used to displace a dilute stream, then liquid front is termed as shockwave.

4. What is water softening?

Ans: Removal of Ca<sup>2+</sup> and Mg<sup>2+</sup> from water is known as water softening.

5. We like to soften water having 3 meq/L Mg<sup>2+</sup> and 5 meq/L Na<sup>+</sup> with superficial feed velocity 8 cm/min and 3 m column is used with CRT=1eq/L, ε<sub>e</sub>=0.4.

Find feed period.

Ans

$$C_T = 3 + 5 = 8 \text{ meq} / L$$

$$x_F = \frac{3}{8} = 0.375$$

$$x_{F,Na} = 0.625$$

$$v = \frac{v_{\text{sup}}}{E_e} = \frac{8}{0.4} = 20 \text{ cm} \cdot \text{min}$$

$$k_{mgNa} = 1.5$$

$$k_{mgNa} \frac{C_{RT}}{C_T} = 1.5 \times \frac{1}{8 \times 10^{-3}} = 187.5771$$

∴ shock wave results

$$x_{a,mg} = X_{f,mg} = 0.375$$

$$\begin{aligned} \frac{y_{a,mg}}{(1-y_{a,mg})^2} &= (k_{mgNa} \frac{C_{RT}}{C_T}) \frac{x_{a,mg}}{(1-x_{a,mg})^2} \\ &= 187.5 \times \frac{0.375}{0.625^2} = 180 \end{aligned}$$

$$(1-y_{amg})^2 = 5.56 \times 10^{-3} y_{amg}$$

$$1-2y_{amg} + y_{amg}^2 = 5.56 \times 10^{-3} y_{amg}$$

$$y_{amg}^2 - 2.00550 y_{amg} + 1 = 0$$

$$y_{amg} = \frac{2.00556 - \sqrt{2.00556^2 - 4}}{2}$$

$$= 0.928$$

$$u_{sh} = \frac{v}{1 + \frac{1}{E_e} + \frac{C_{RT}}{C_T} k_E \left( \frac{y_{amg} - y_{bmg}}{X_{amg} - X_{bmg}} \right)}$$

$$y_{bmg} = X_{bmg} = 0$$

$$u_{sh} = \frac{20}{1 + \frac{1}{0.4} + \frac{1}{8 \times 10^{-3}} \times 1.5 \left( \frac{0.928}{0.375} \right)}$$

$$= 0.0172 \text{ cm/min}$$

$$t_F = \frac{300}{0.0172} = 17415 \text{ min} = 290 \text{ hrs}$$