

Carbonic Acid System

- Ionization Fractions (cont'd)

$$\alpha_0 = \frac{1}{1 + \frac{K_1}{[H^+]} + \frac{K_1 K_2}{[H^+]^2}}$$

$$\alpha_1 = \frac{1}{1 + \frac{[H^+]}{K_1} + \frac{K_2}{[H^+]}}$$

$$\alpha_2 = \frac{1}{1 + \frac{[H^+]}{K_1 K_2} + \frac{[H^+]}{K_2}}$$

only
find
 α_1

Carbonic Acid System

- Total Carbonic Species or Total Alkalinity

$$C_T = \frac{1}{\alpha_0} \left[\frac{2[Alk] - \frac{K_w}{[H^+]} + [H^+]}{\frac{2K_1 K_2}{[H^+]} + \frac{K_1}{[H^+]}} \right]$$

$$[Alk] = \frac{1}{2} \left\{ \alpha_1 C_T \left[\frac{2K_2}{[H^+]} + 1 \right] + \frac{K_w}{[H^+]} - [H^+] \right\}$$

Sludge Weight and Volume

- Sludge Solids
 - Total Solids (TS) ~ 103 °C
 - Volatile Solids (VS) ~ 550 °C
 - Fixed or Nonvolatile Solids (NVS)
- Specific Gravity for Composite Dry Solids

$$\frac{W_d}{S_d \gamma} = \frac{W_f}{S_f \gamma} + \frac{W_v}{S_v \gamma}$$

Sludge Weight and Volume

- Specific Gravity for Composite Dry Solids
 - W_d = weight of dry solids
 - W_f = weight of fixed solids
 - W_v = weight of volatile solids
 - S_d = sp. gr. of dry solids
 - S_f = sp. gr. of fixed solids (~ 1.5 to 2.5)
 - S_v = sp. gr. of volatile solids (~ 1.2 to 1.4)
 - γ = unit weight of water

Sludge Weight and Volume

- Specific Gravity for Composite Wet Solids

$$S_w = \frac{W_w + W_d}{(W_w/1.00) + (W_d/S_d)}$$

- S_w = sp. gr. of wet sludge
- W_w = weight of water
 - note that S_w increases as % solids in the sludge increases (~ unity for dilute chemical sludge)

Sludge Weight and Volume

- Volume of Wet Sludge (V)

$$V = \frac{W_d}{(s/100) \gamma S_w} = \frac{W_d}{(s/100) \rho_s}$$

- s = solids content (%)
- ρ_s = sludge density
 - note that V decreases as % solids in the sludge increases; for every doubling of solid content the sludge volume is cut in half