

pH-sensitive hydrogel

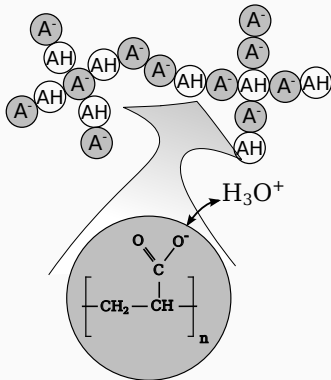


Figure 3: Each bead of hydrogel is acidic. It changes its charge depending on pH.

- ionization reaction



- ionization equilibrium

$$\frac{\alpha}{1 - \alpha} = \frac{c_{\text{H}^+}^{\text{in}}}{K} = \frac{c_{\text{H}^+}^{\text{out}}}{K} \frac{c_{\text{H}^+}^{\text{in}}}{c_{\text{H}^+}^{\text{out}}} = 10^{pK - pH} \xi^{-1}$$

$$\frac{\alpha}{1 - \alpha} = 10^{pK - pH} \left(\sqrt{1 + \left(\frac{\alpha c_p}{2c_s} \right)^2} \mp \frac{\alpha c_p}{2c_s} \right)$$

- Free energy ionization term

$$F_\alpha = \alpha N (\ln \alpha + \ln(1 - \alpha) + \ln c_{\text{H}^+}^{\text{in}} - \ln K)$$