

## Theoretical Assessments

- **Application of Flory-Huggins theory to polymer-API blends**

- According to F-H theory, the Gibb's free energy of mixing of polymer-API blend can be expressed as :

$$\Delta G_{\text{mix}} = \Delta H_{\text{mix}} - T\Delta S_{\text{mix}}$$

$$\Delta G_{\text{mix}} = RT\left(\varphi_{\text{drug}}\ln\varphi_{\text{drug}} + \frac{\varphi_{\text{polym}}}{m}\ln\varphi_{\text{polym}} + \chi_{\text{drug-polym}}\varphi_{\text{drug}}\varphi_{\text{polym}}\right)$$

Where  $m$  is the ratio of the molecular volume of polymer to drug and  $\varphi$  is volume fraction.

- For a drug and a polymer without specific interactions, the Flory–Huggins interaction parameter is determined from the solubility parameters of those two components:

$$\chi_{\text{drug-polym}} = \frac{V_{\text{lattice}}}{RT} (\delta_{\text{drug}} - \delta_{\text{polymer}})^2$$

- A small value of  $\chi$  leads to a small magnitude of enthalpy of mixing and a more negative free energy, favoring the mixing.