

Separation Methods Based on Distributions in Discrete Stages (8/30/13)

1. Chemical Separations: The Big Picture

Classification and comparison of methods

2. Fundamentals of Distribution Separations

3. Separation Methods Based on Distributions in Discrete Stages

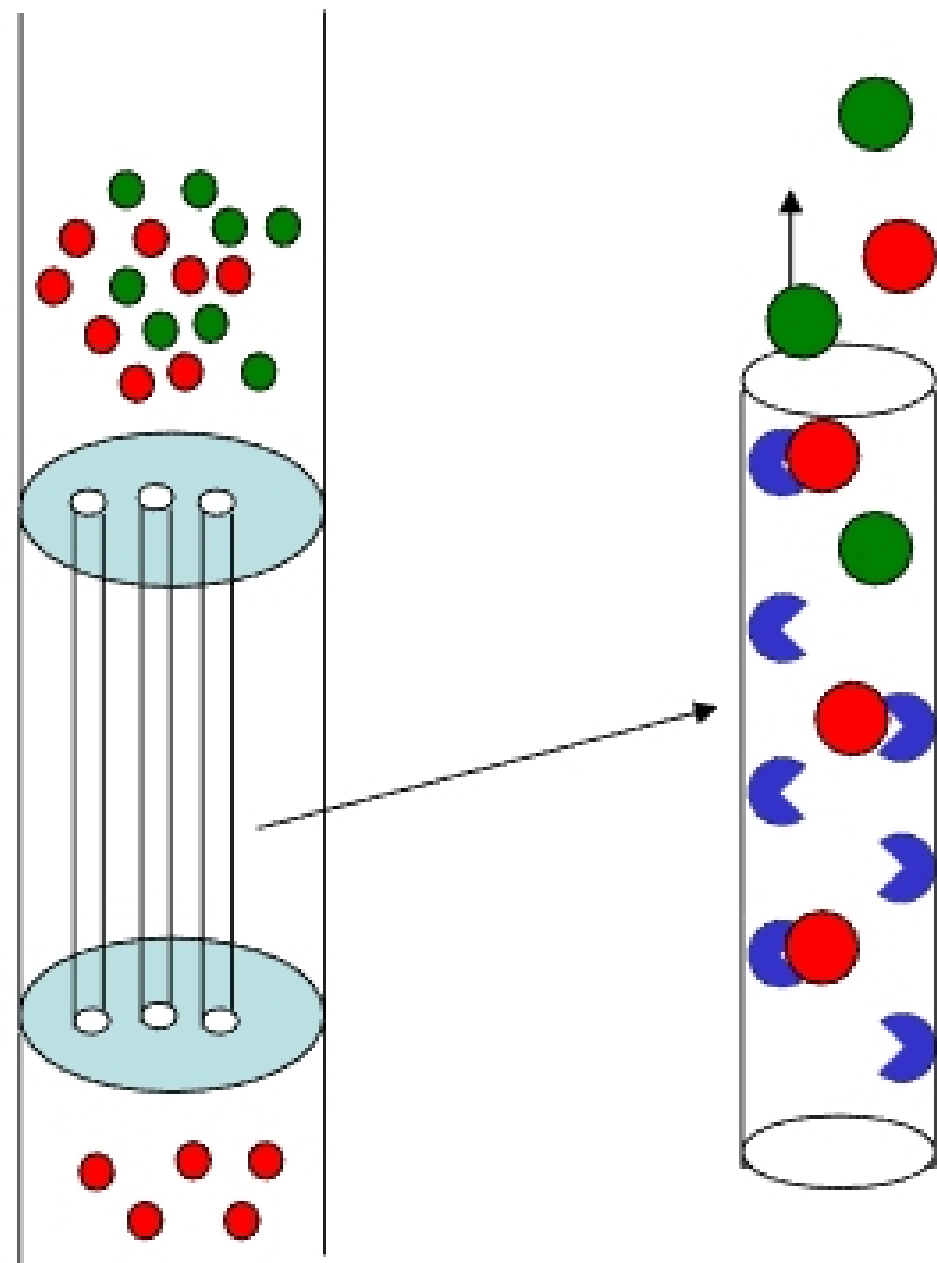
Such as solvent extraction and distillation

4. Introduction to Distribution Separations in chromatographic

methods. The plate theory, the rate theory; van Deemter's equation.

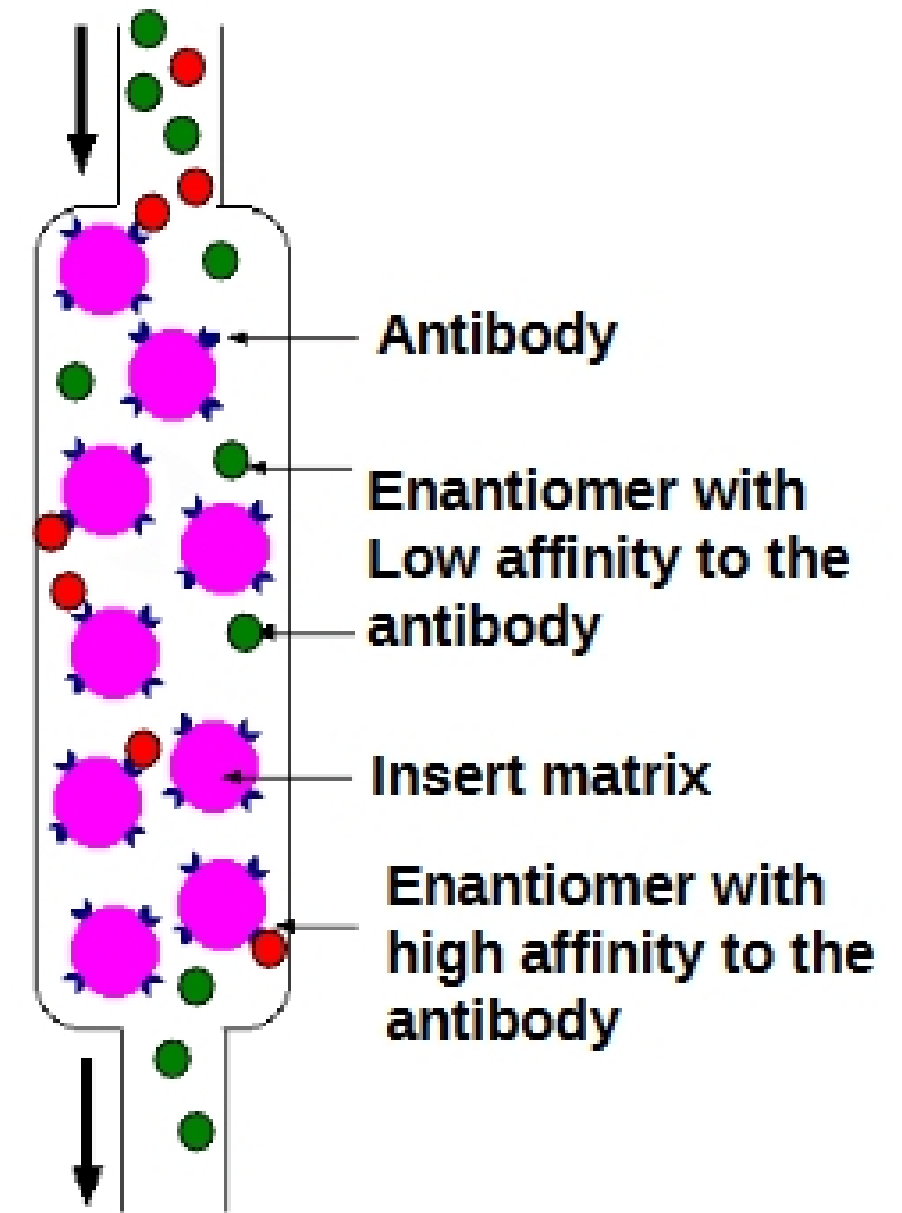
Question: What Controls the Selectivity of Nanotubes?

Enantiomers



nanotube

Affinity



Affinity Chromatography

1. Lakshmi, B.; Martin, C.R. "Enantioseparation Using Apoenzymes Immobilized in a Porous Polymeric Membrane," Nature, 1997, 388, 758-760.

Why ?

Entropy Effects in Phase Distribution

$$K = \exp\left(\frac{-\Delta\mu_i^0 - \Delta\mu_i^{\text{ext}}}{RT}\right) \text{ distribution coefficient}$$

$$\Delta\mu_i^0 = \Delta\bar{H}_i^0 - T\Delta\bar{S}_i^0$$

- (1) The entropy change ($\Delta\bar{S}_i^0$)** relates to the way the solute molecule i fits into the liquid structure of two respective phases and the associated reorientation and repositioning of the liquid molecules.
- (2) In most separation cases**, the structural changes accompanying the arrival of a solute molecule are similar in different phases, and thus the entropy term is much smaller than the enthalpy term.
- (3) In the case of hydrophobic interaction**, the presence of non-polar intruder induces a semi-rigid structure in the surrounding water molecules, and leads to a significant reduction in entropy. In such case, the entropy change play a major role in influencing phase distribution.