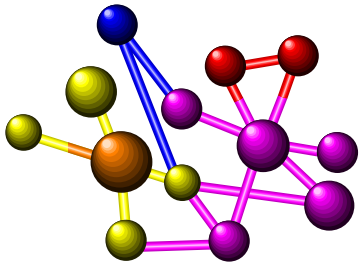
Flocculation and Coagulation

A Practical Guide

for

Mining and Mineral Processing



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Presentation Outline

- Polymer Chemistry - tools
- Coagulation and Flocculation Basics
- Factors affecting Polymer performance
- Flocculant solution Preparation
- What's new in Solids - Liquid separation

Polymer Chemistry

- **Description...** **Poly + Mer**
  MANY UNITS
- **Types...**
  - Coagulants (cationic, anionic)
  - Flocculants (non-ionic, anionic, cationic)
  - natural polymers (starch, lignins...)
- **Characteristics...**
  - Low, Medium or High Molecular Weight
  - Low, Medium or High Charge Density

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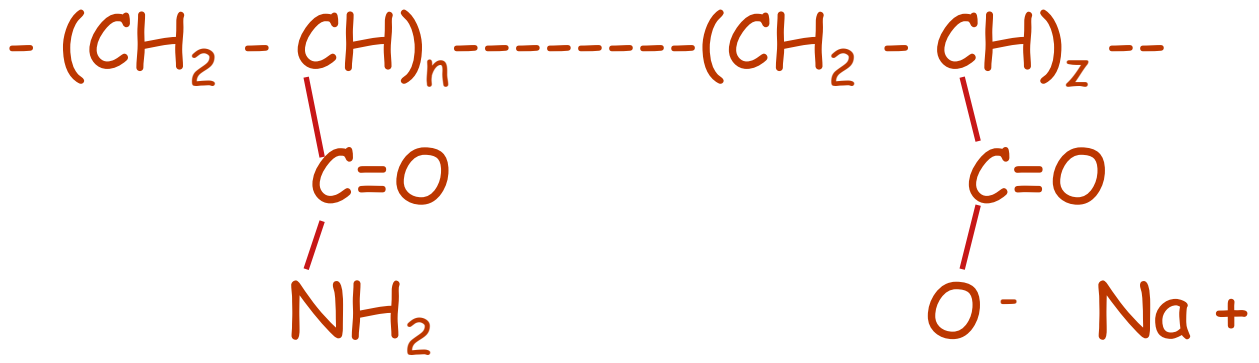
Coagulant & Flocculant Characteristics

CHARACTERISTIC	COAGULANT	FLOCCULANT
Molecular Weight	Low (,000's)	Very High (millions)
Charge Type	Cationic (+) Anionic (-)	Cationic (+) Anionic (-) Nonionic (o)
Charge Density	High	Low Medium High Very High

Flocculants in Mineral Processing

The majority of Flocculants used in mineral processing have molecular weight ~20 million are combinations of

$(Acrylamide)_n$ and $(Sodium\ Acrylate)_z$



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Coagulation

- **Coagulation-Theory**
  - Is particle destabilization by a reduction of the charges tending to keep the particles apart.

- **Coagulation is a 3 part process**
  - 1. Rapid mixing of the coagulant with the raw water (dispersion)
  - 2. Neutralization of particle surface charges
  - 3. Collision between neutralized particles caused by the input of rapid mix energy

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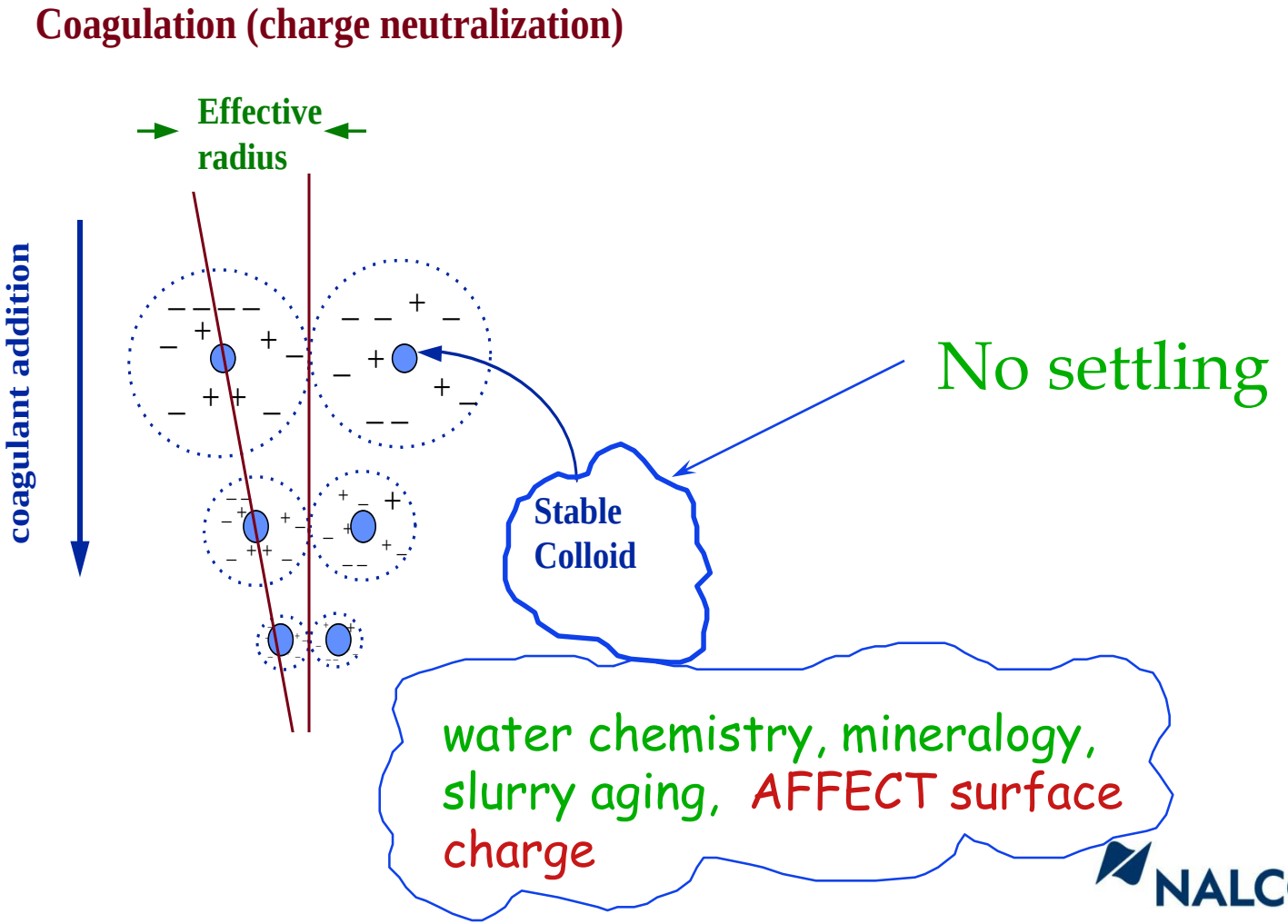
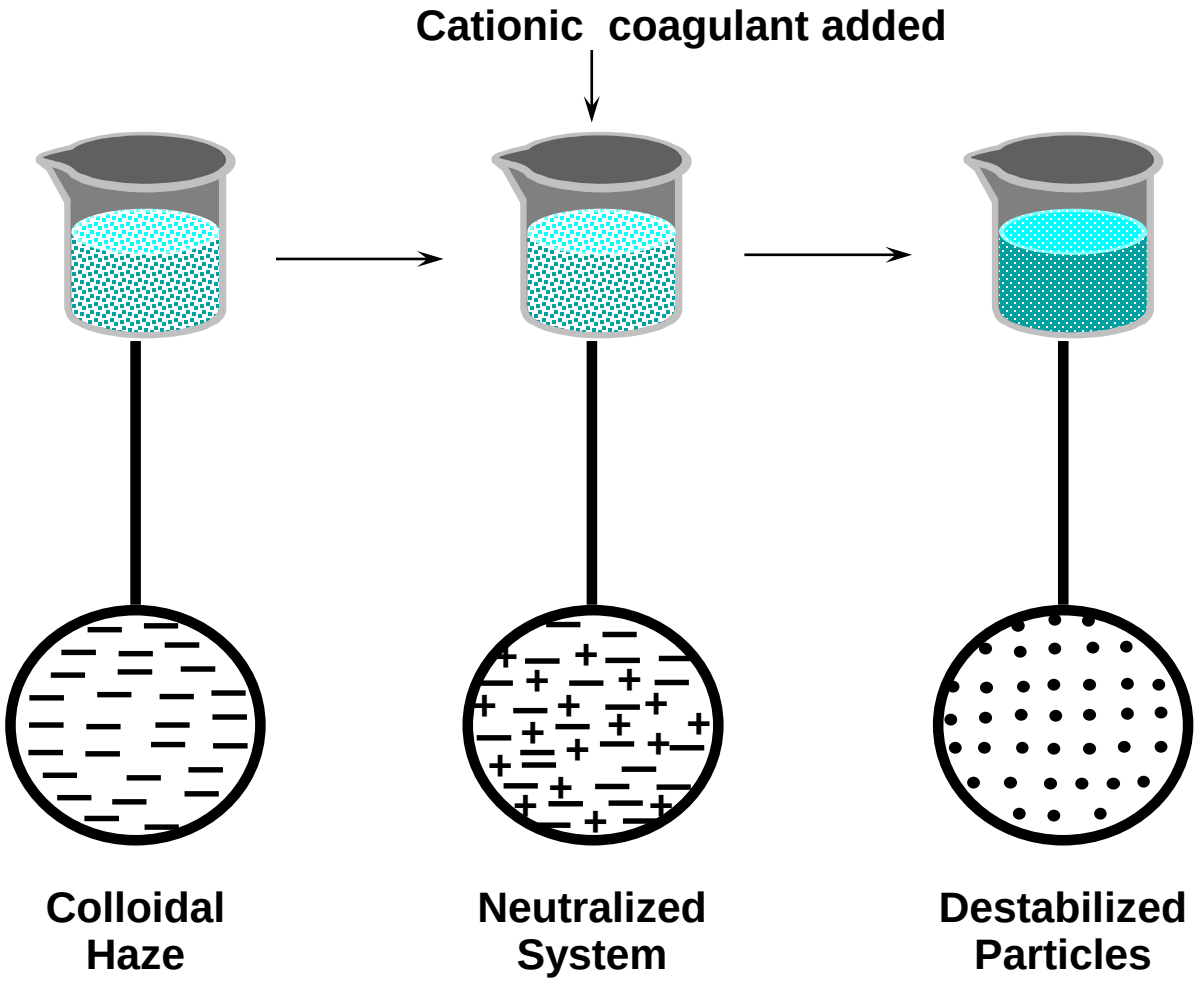
Coagulation - Theory



Coagulation - The Process



Flocculation

- **Flocculation**
  - The "physical" bridging of particles through the use of a polymeric flocculant
  - The agglomerated particles because of their size and density sink causing solid/liquid separation.

  (Stokes Law $V=2gr^2(d_1-d_2)/9n$)

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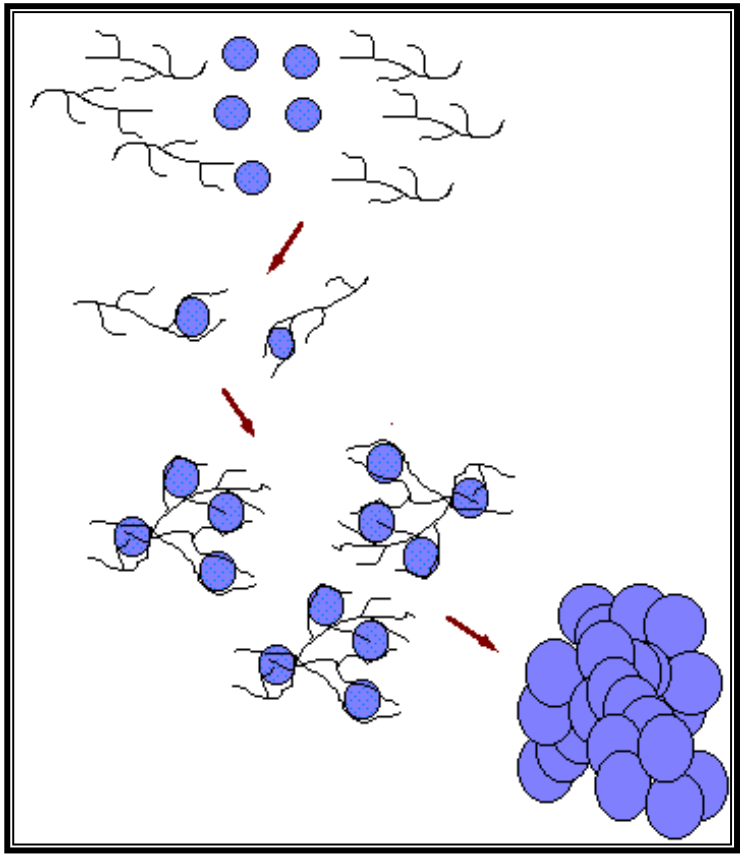
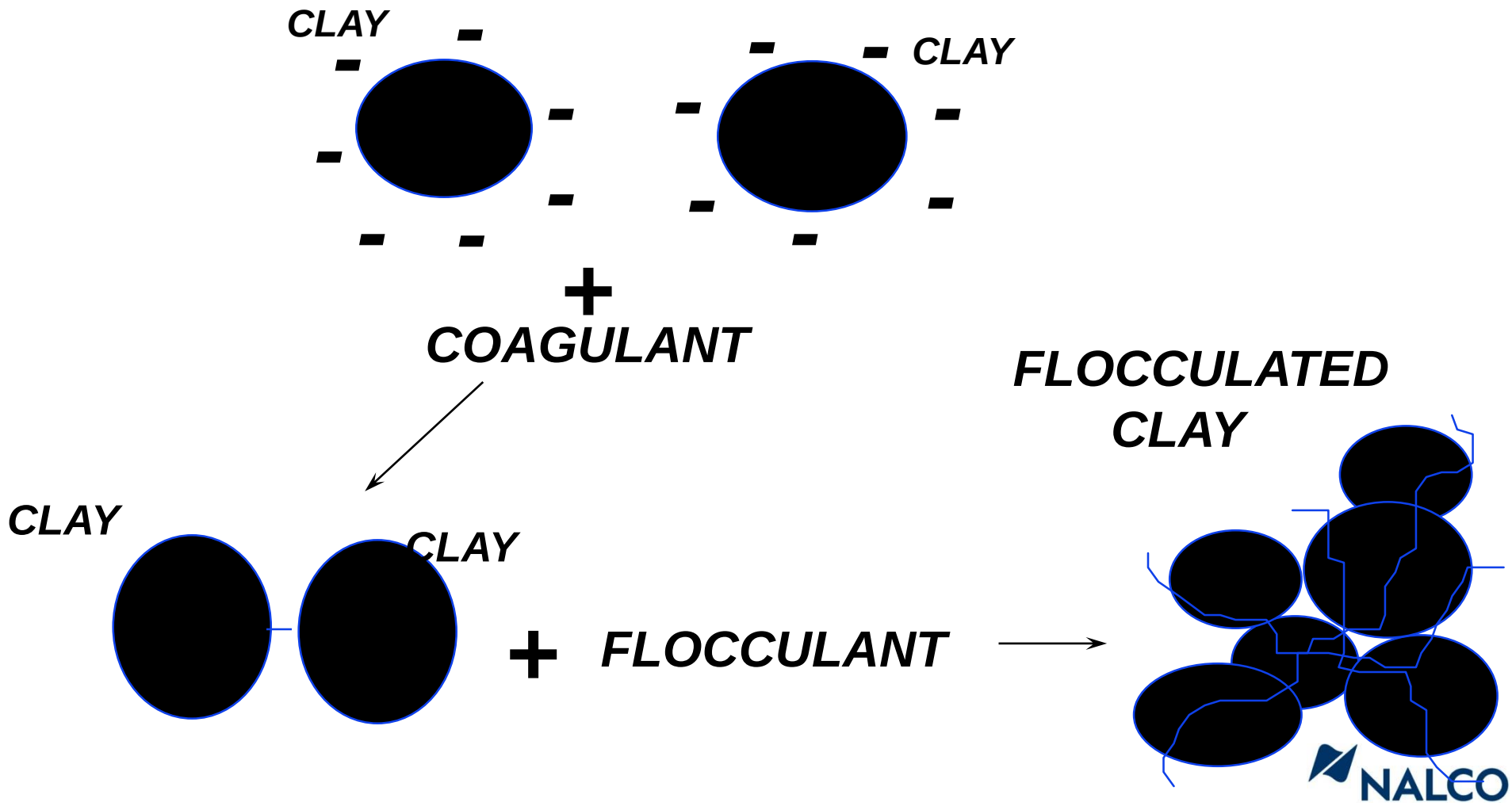
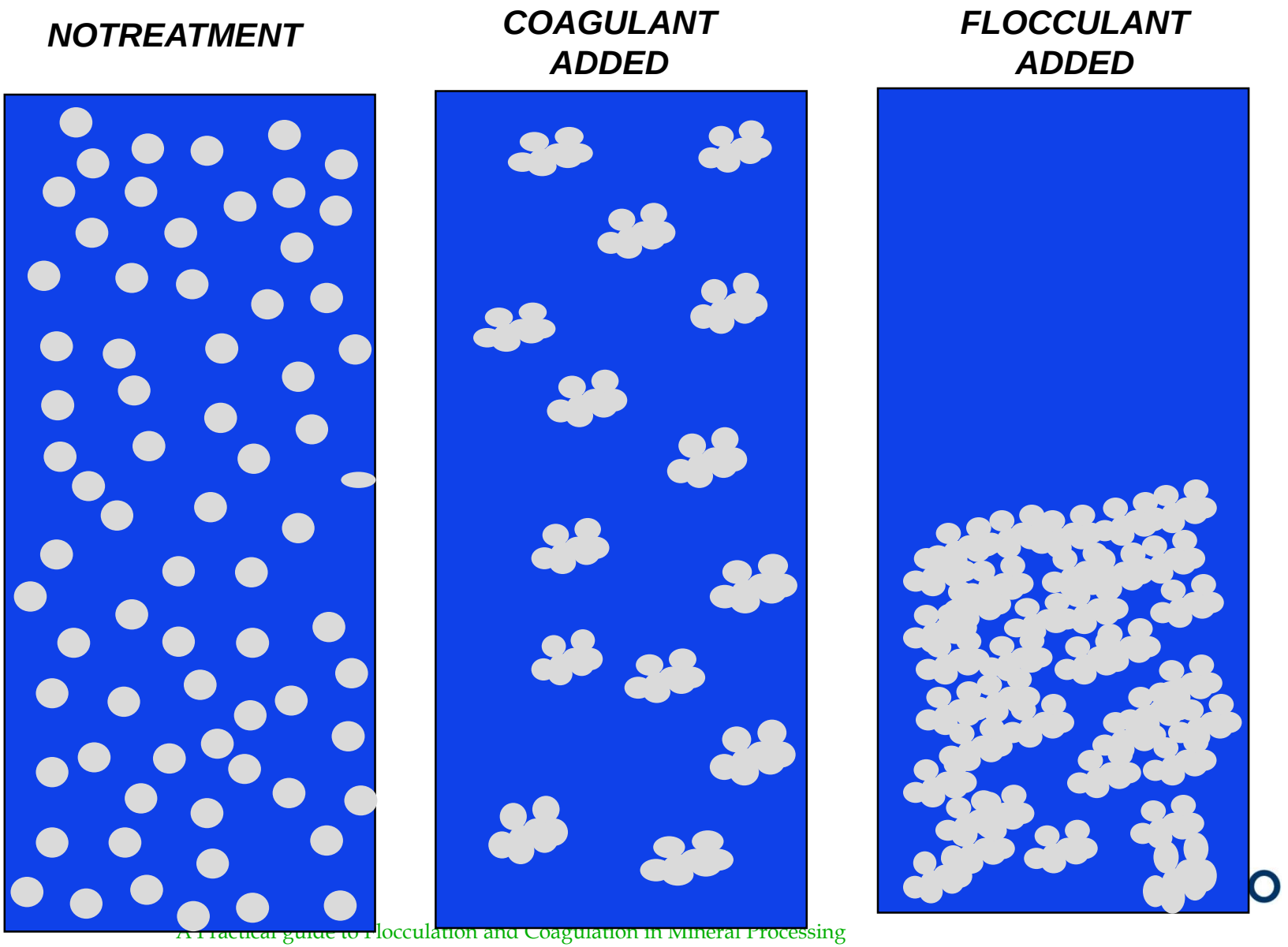
Flocculation - mechanism



Coagulation & Flocculation



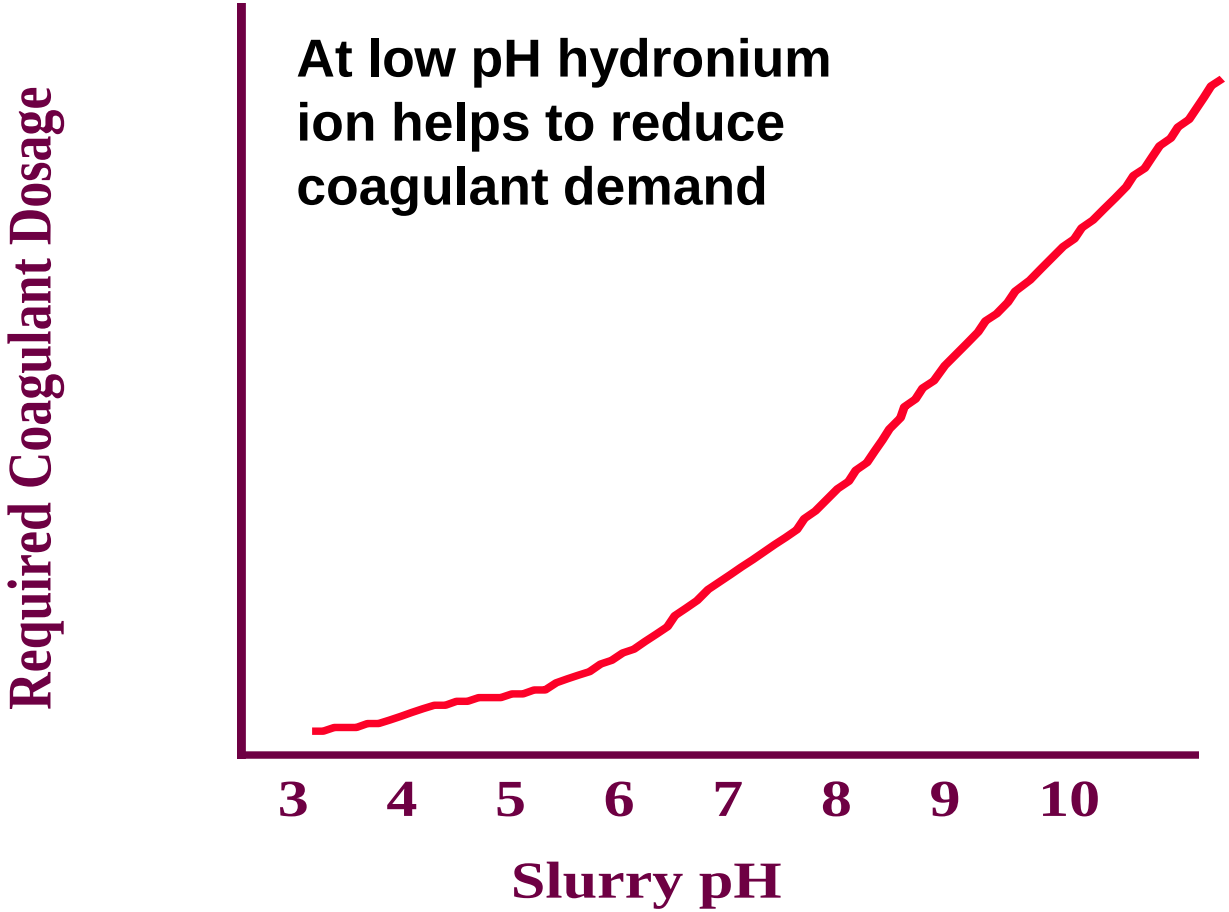
Coagulation and Flocculation



Factors Affecting Flocculant Performance

- **Particle Size** (fine particles, high surface area and high floc demand)
- **Solids Concentration** (too high solids conc. can hinder settling performance)
- **Water Chemistry** (pH, iron, hardness)
- **Mineralogy** (surface chemistry)
- **Flocculant Type** (mining typically low anionic)
- **Method of Addition** (coag high shear, floc low shear + dilution + short contact))

Water pH - Coagulant



Flocculant Injection

THE 3 D'S OF DOSING:

- DILUTION
- DOSE POINT/S
- DISTRIBUTION (mixing)

Visual Demonstration

Thank You

Questions?

Comments