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Drying Process of Latex Dust Suppressant Films

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Attributes of Dust Suppressants

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Variety of Dust Suppressants

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- Water
- Wetting agents added to water
- Moisture Absorbing Products
- Organic Petroleum Products
- Organic Non-petroleum
- Electrochemical
- Synthetic Polymer
- Clay Additives

A Latex Dust Suppressant consists of colloidal polymeric particles, ranging in size between 1 nm ($1x10^{-9}$ meter) and 1µm ($1x10^{-6}$ meter), that are dispersed in water. The dispersed particles are in constant motion (Brownian Motion), which help provide product stability. After applied to a surface, the liquid evaporates and Latex particles gradually coalesce to form a continuous film.

Common Materials in Latex Dust Suppressants

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- **Polymers;**
  - Primary film generating ingredient
- **Coalescing agents;**
  - Softens latex polymer to allow them to combine together during film generation
- **Wetting agents;**
  - Multiple functions: wetting, dispersing, dispersion stabiliser, & emulsifying

Common Materials in Latex Dust Suppressants

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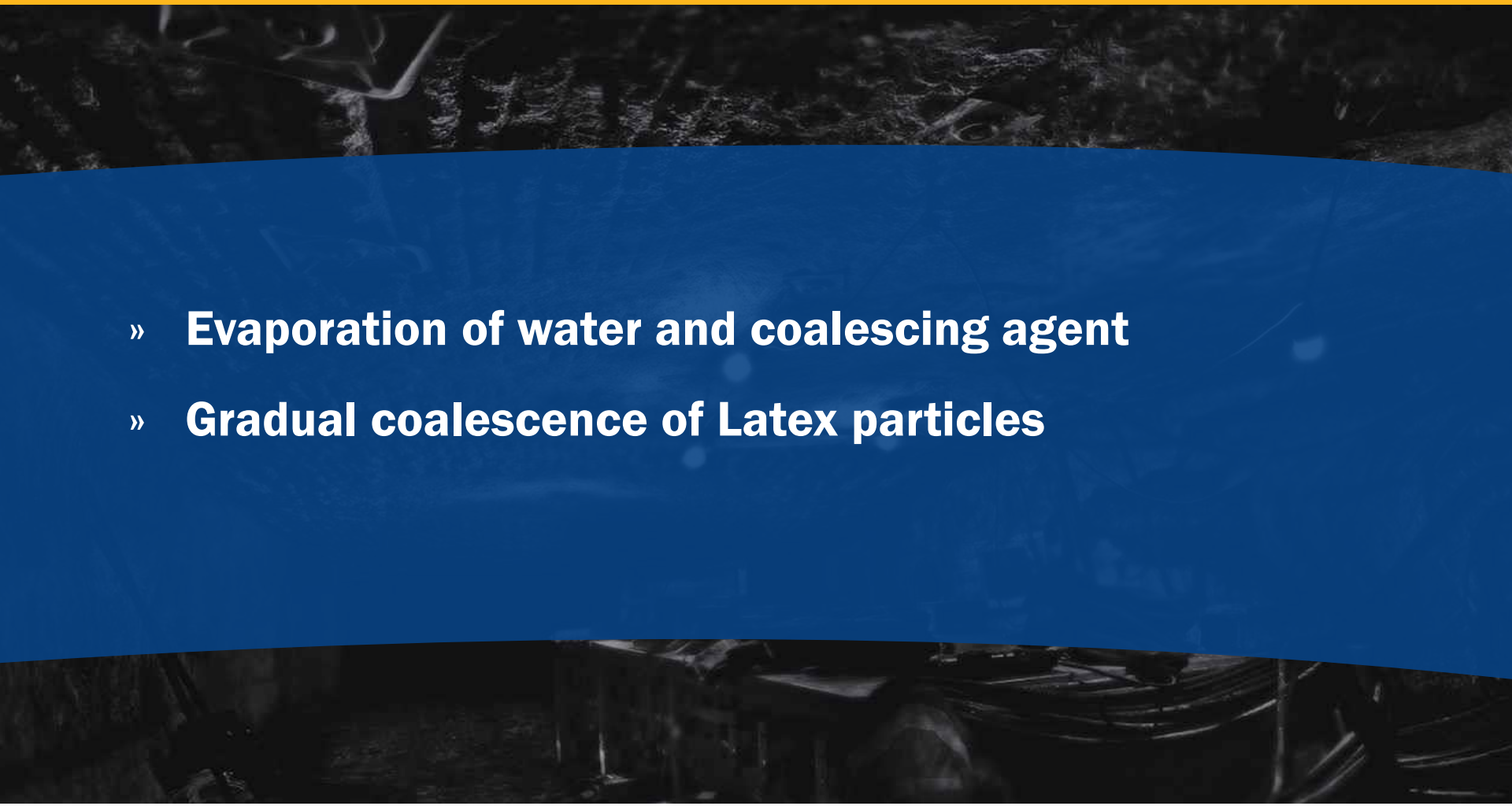
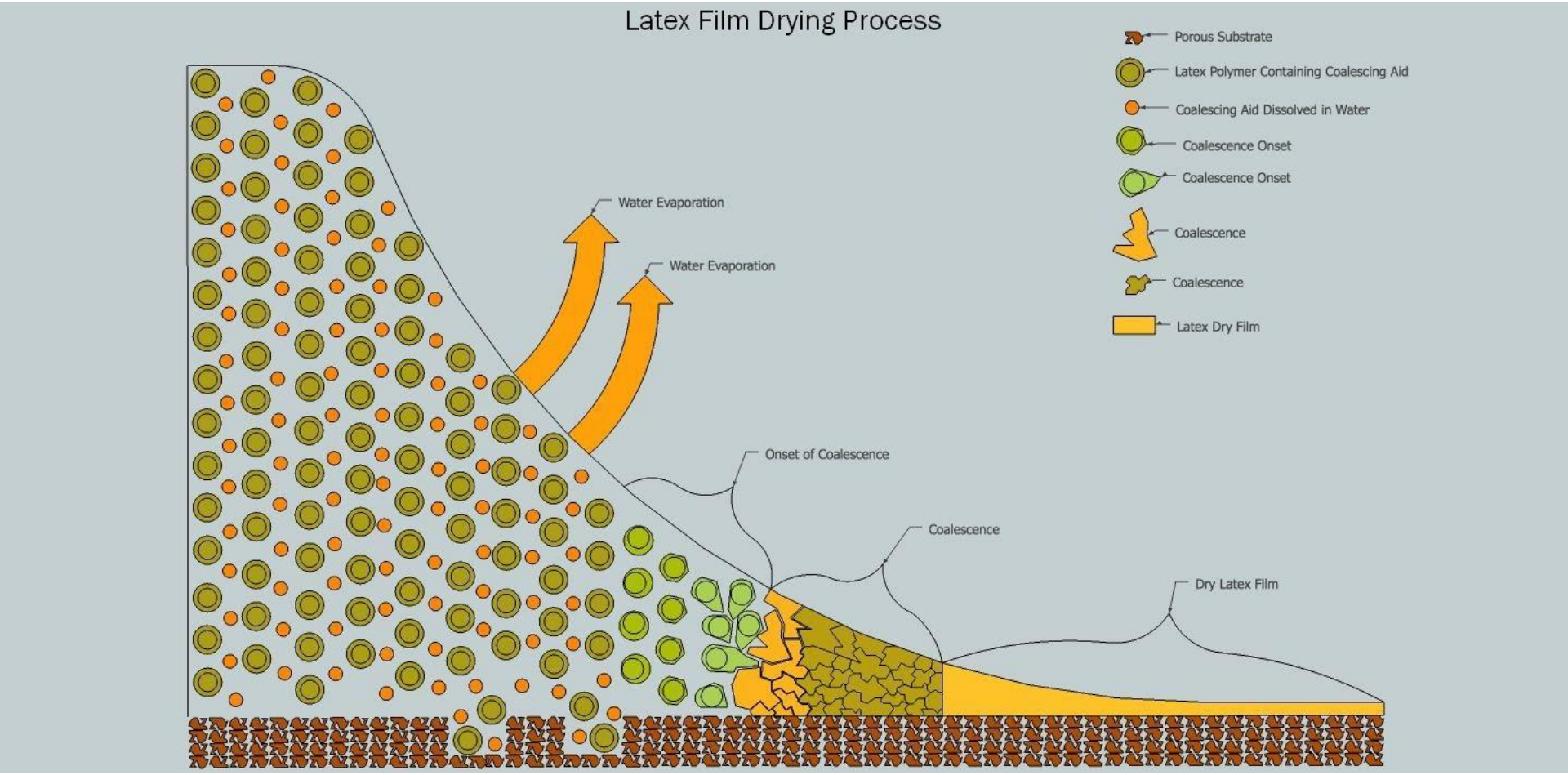
- **Viscosity modifiers;**
  - Not often used in Latex dust suppressants
- **Stability additives;**
  - Essential for providing a stable concentrate & application emulsion
- **Water;**
  - Main carrier of all ingredients

Film Formation Process Phases



- Evaporation of water and coalescing agent
- Gradual coalescence of Latex particles

Evaporation Process



Evaporation Data of Lab Sample

8.2cm dish at RT

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Time	Film Appearance	Liquid and solid weight	Liquid weight	Percent Evaporation
Start	White emulsion	7.8475	7.7575	0
Day 2	White emulsion	1.8508	1.7608	77.3020
Day 3	Clear film	0.091	0.0010	99.9871
Day 4	Clear film	0.0908	0.0008	99.9897
Day 5	Clear film	0.0904	0.0004	99.9948
Day 8	Clear film	0.0906	0.0006	99.9923
Day 9	Clear film	0.0911	0.0011	99.9858
Day 10	Clear film	0.0908	0.0008	99.9897
Day 11	Clear film	0.0900	0	100.0
Day 12	Clear film	0.0900	0	100.0

Factors Effecting Evaporation Rate

- Strength of application mixture & application rate
- Amount of exposed surface area
- Solar radiation and air temperature
- Air flow or wind speed above the emulsion
- Increase emulsion temperature will increase the evaporation rate
- Air humidity

Coalescent Additive Properties

- Active solvent for the base polymer
- Lowers the Minimum Film Forming Temperature (MFFT) of the polymer
- Low solubility in water
- Has an evaporation rate lower than water

Latex Emulsion Spraying System

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Spraying Latex Emulsion on Sand

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Conclusions

- Concentration of Latex Dust Suppressant application mixture influences Drying Process
- Weather conditions influence Drying process
- Complete Drying Process can take up to 10 days