Understanding mixing, the first step to a solution

5 | Apr| 16

CONTENT

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Mixing mechanisms

Mixers

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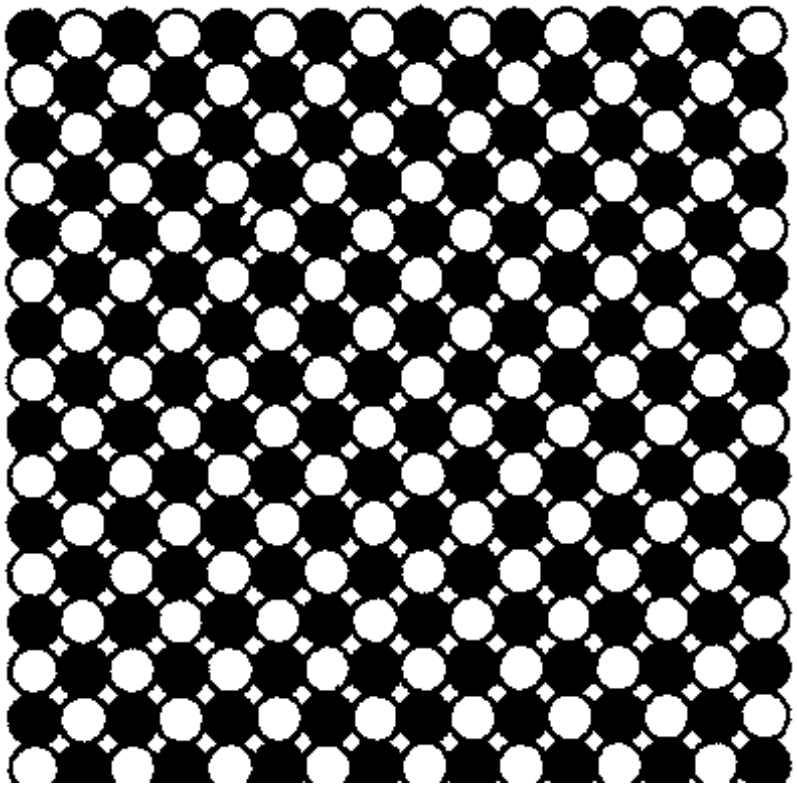
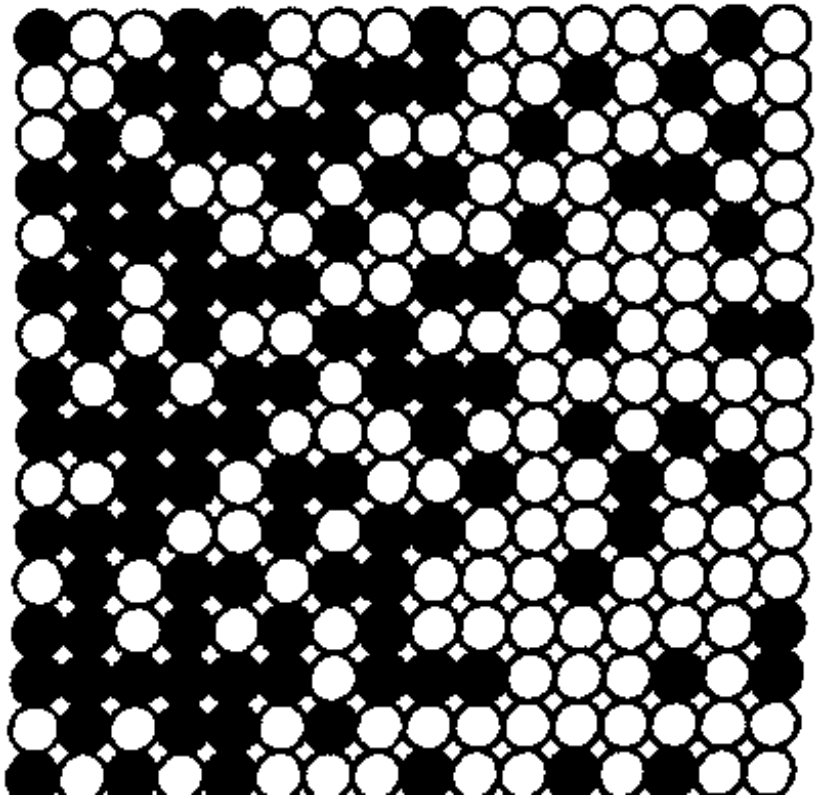
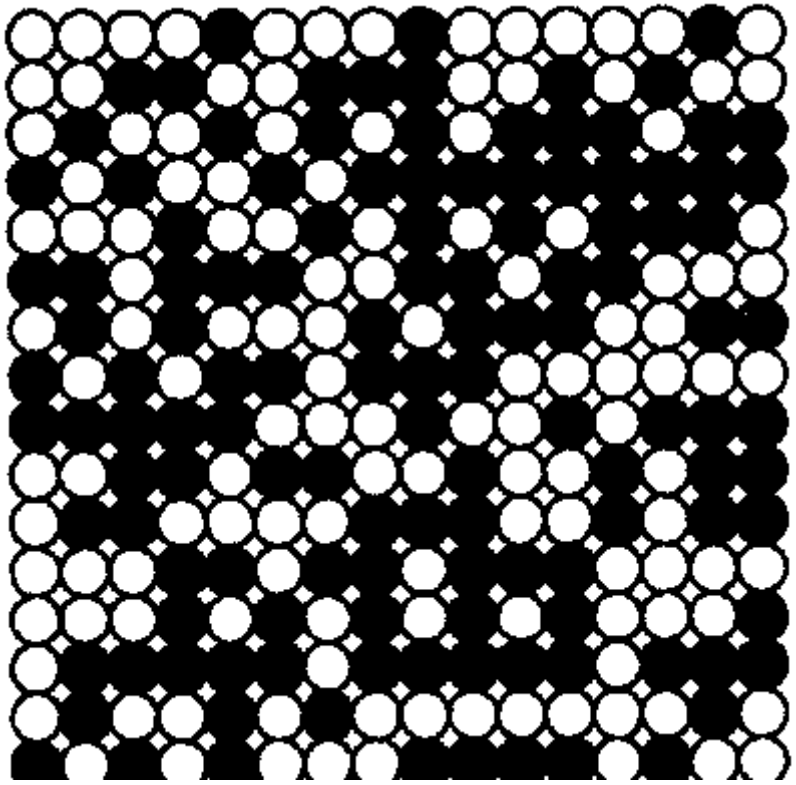
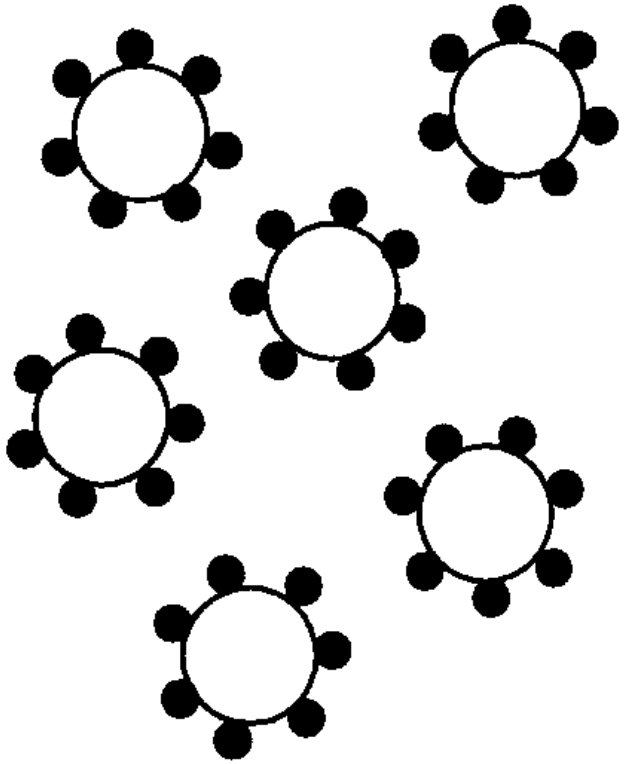
TYPES OF MIXTURES



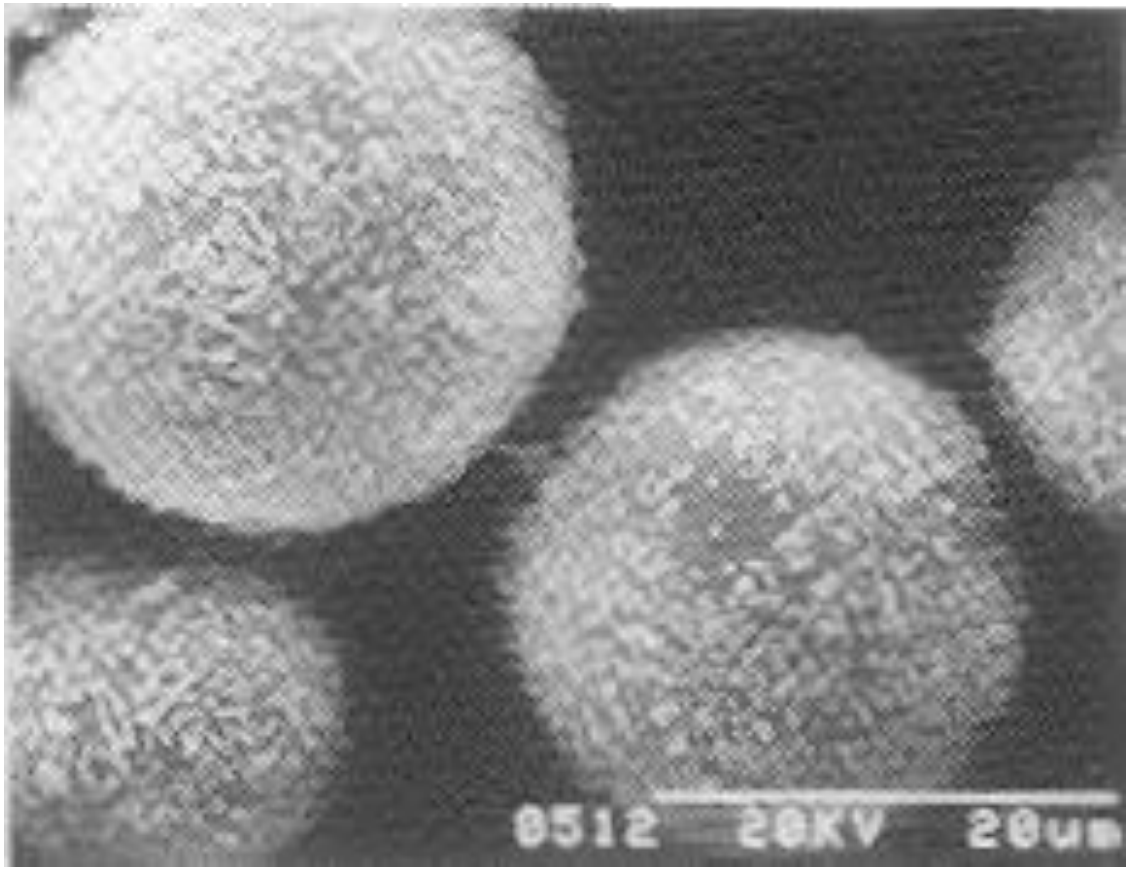


TYPES OF MIXTURES

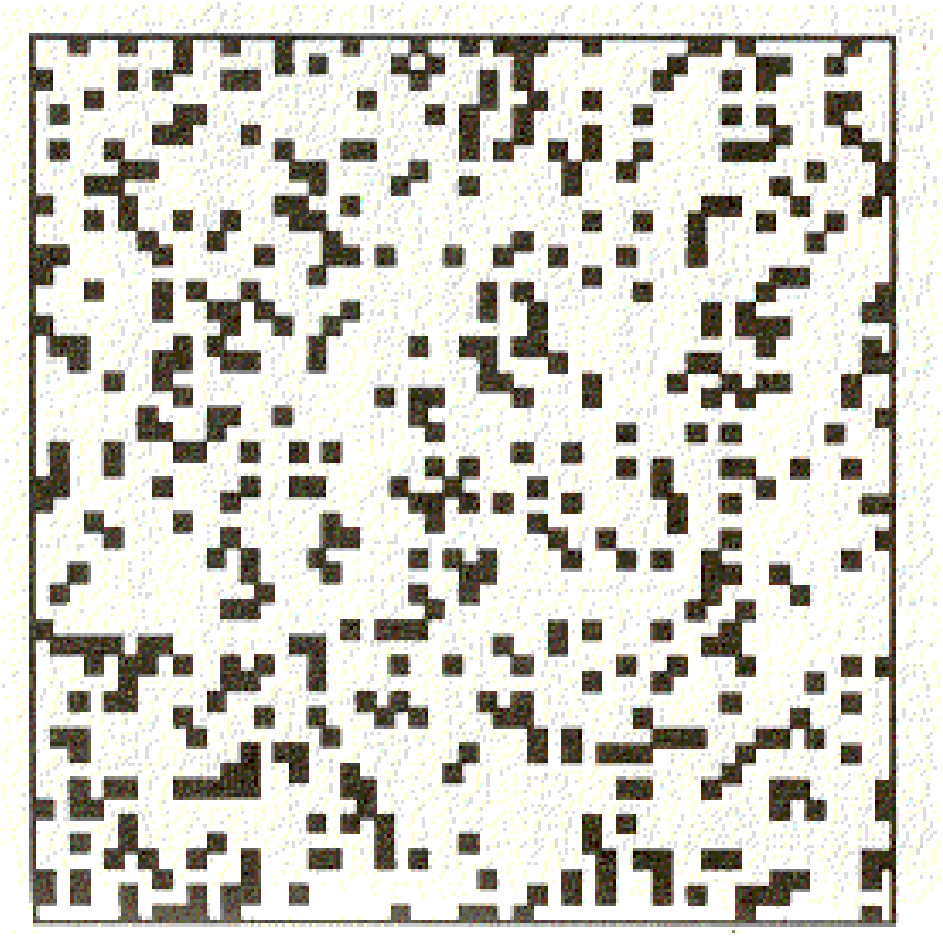




ORDERED MIXTURE



A GOOD MIXTURE?



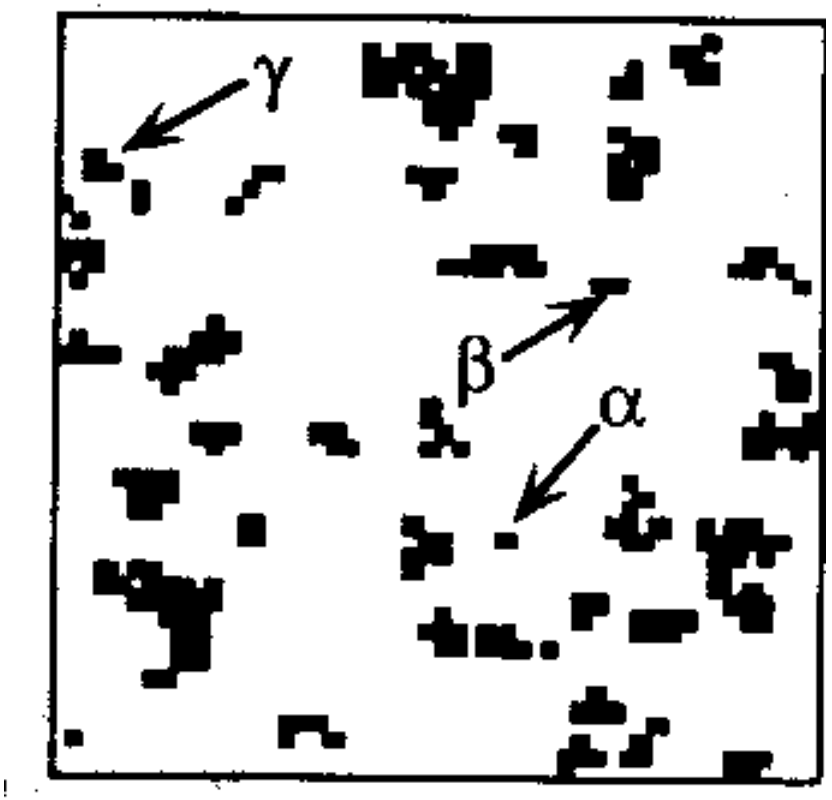
MECHANISMS OF MIXING

Diffusion- redistribution of particles by random motion

Convection - transfer from one location to another by external force

Shear formation of slip planes

DIFFUSION



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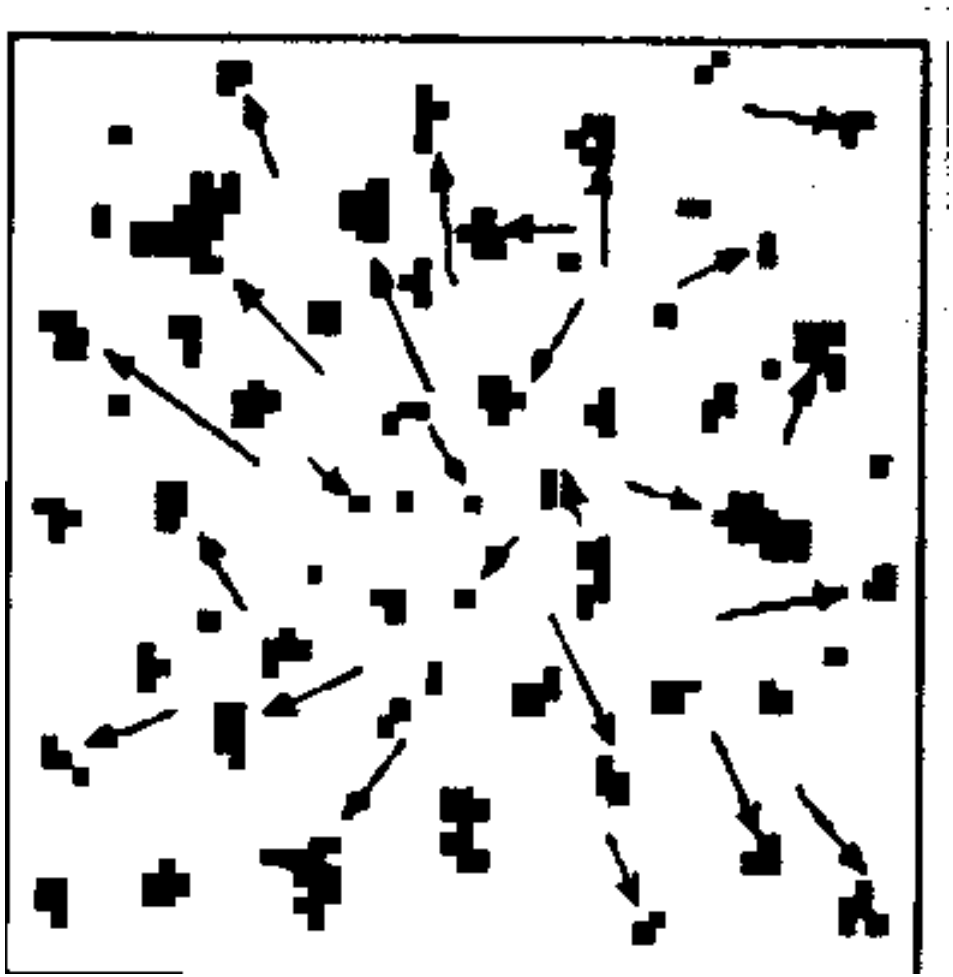

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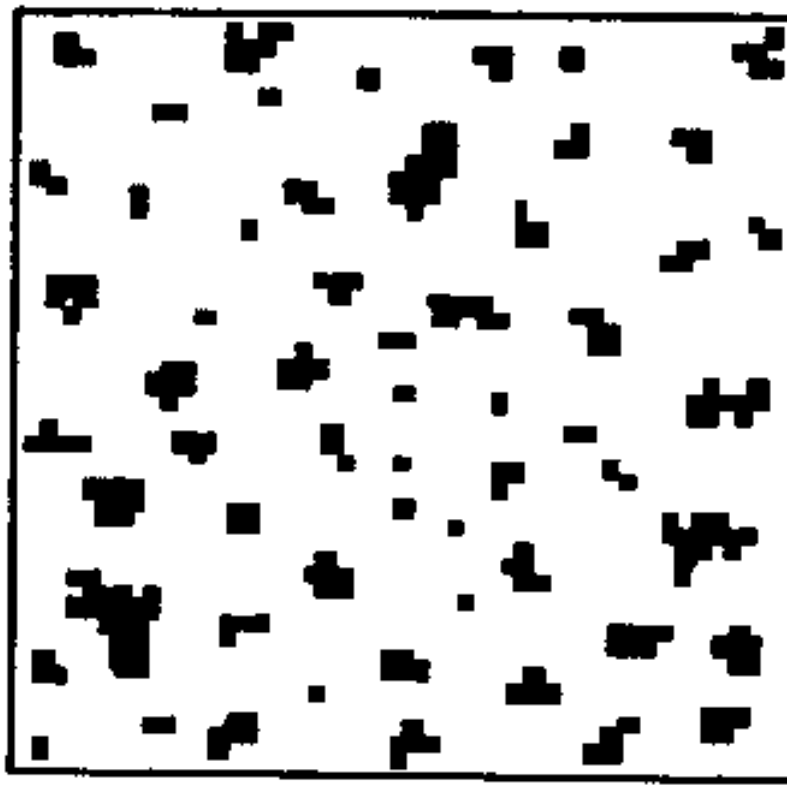
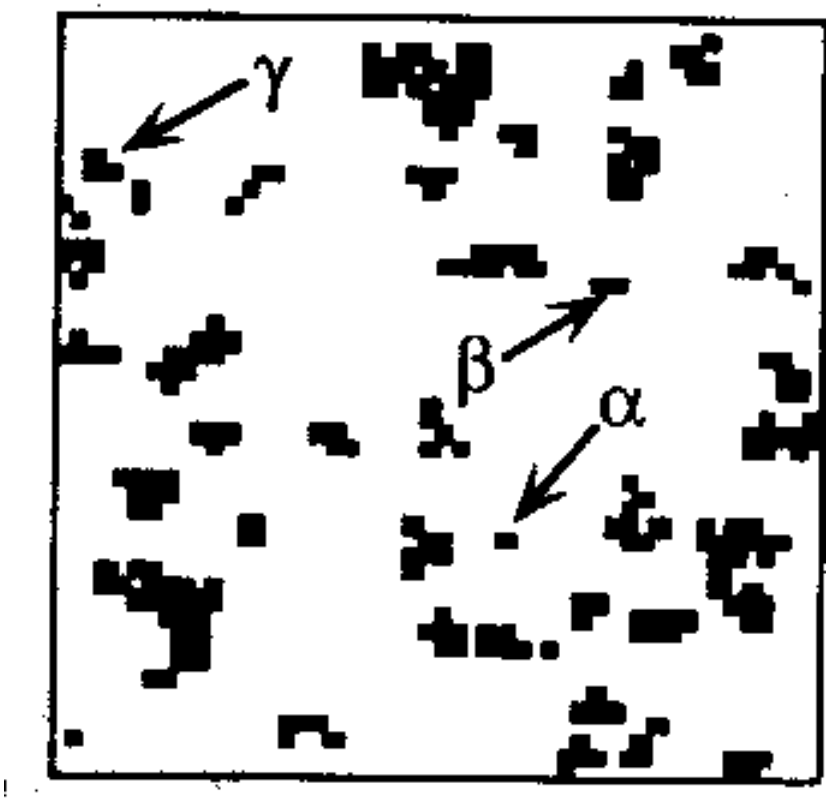


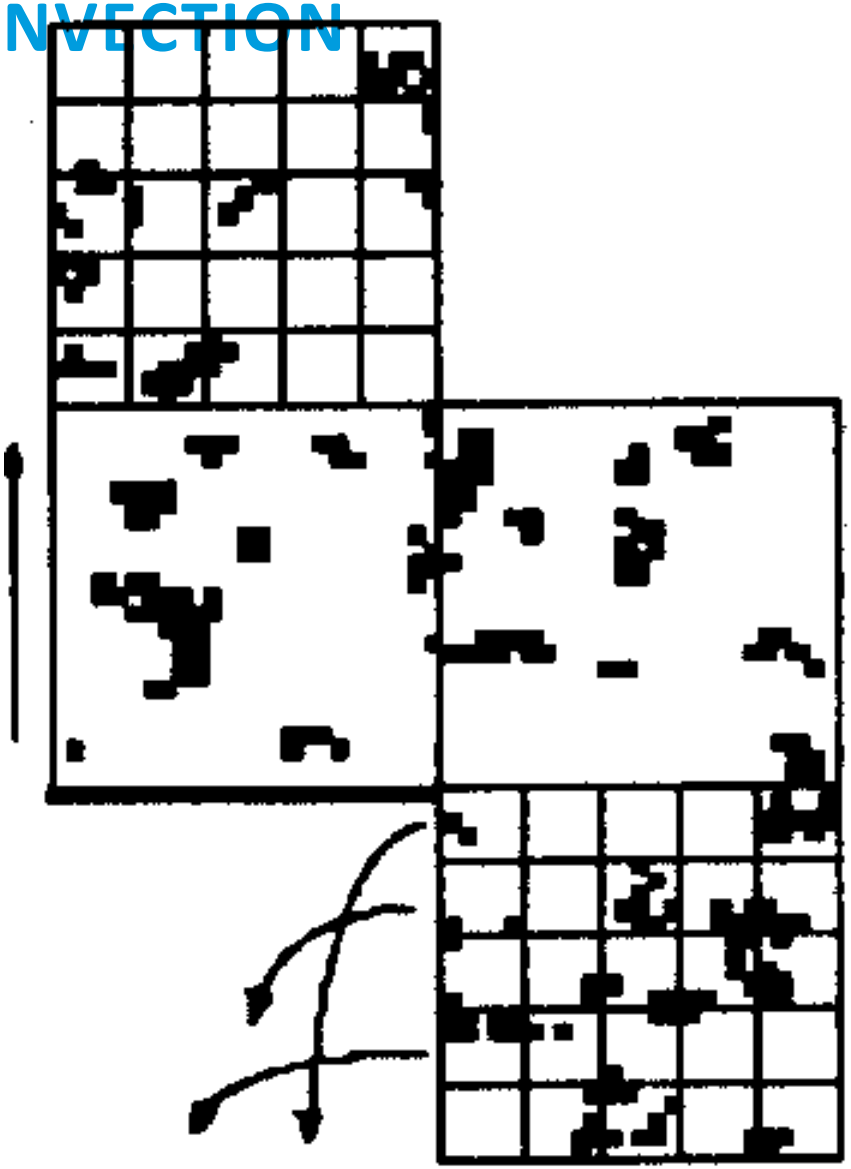
TUMBLER MIXERS:

DOUBLE CONE BLENDER

CONVECTION



CONVECTION



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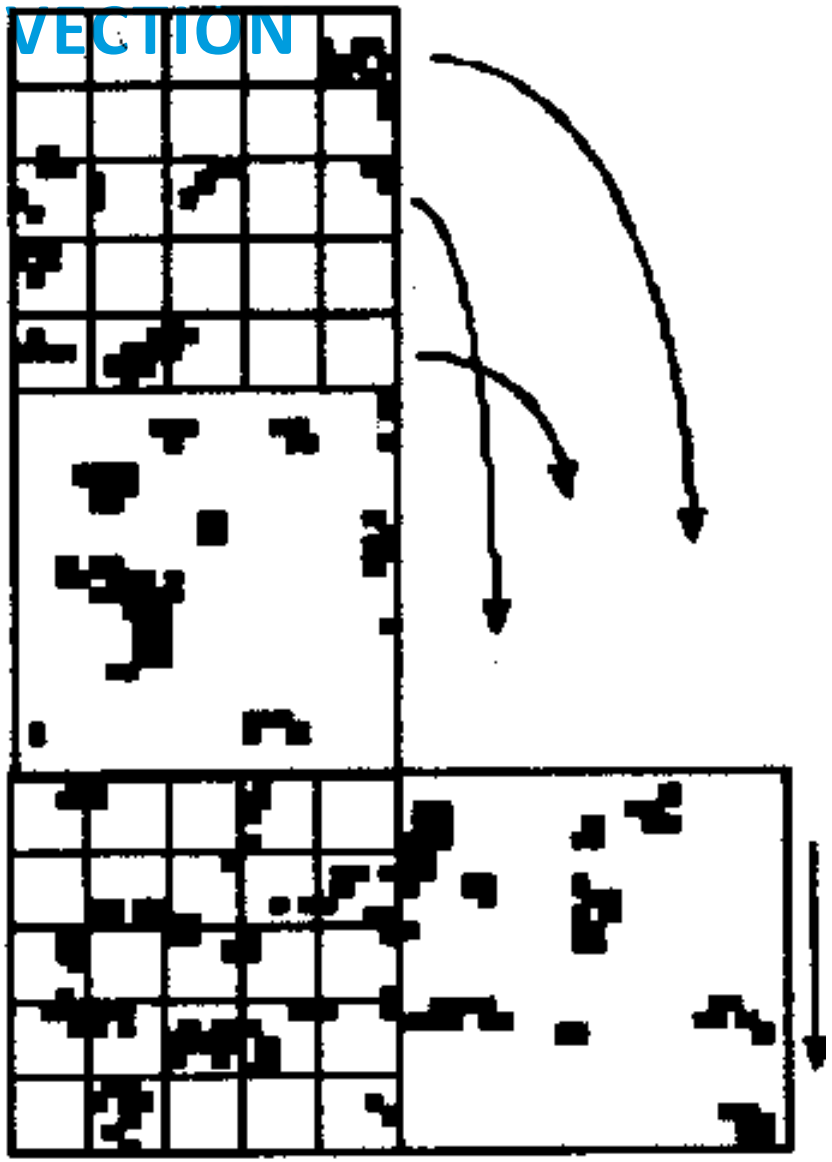
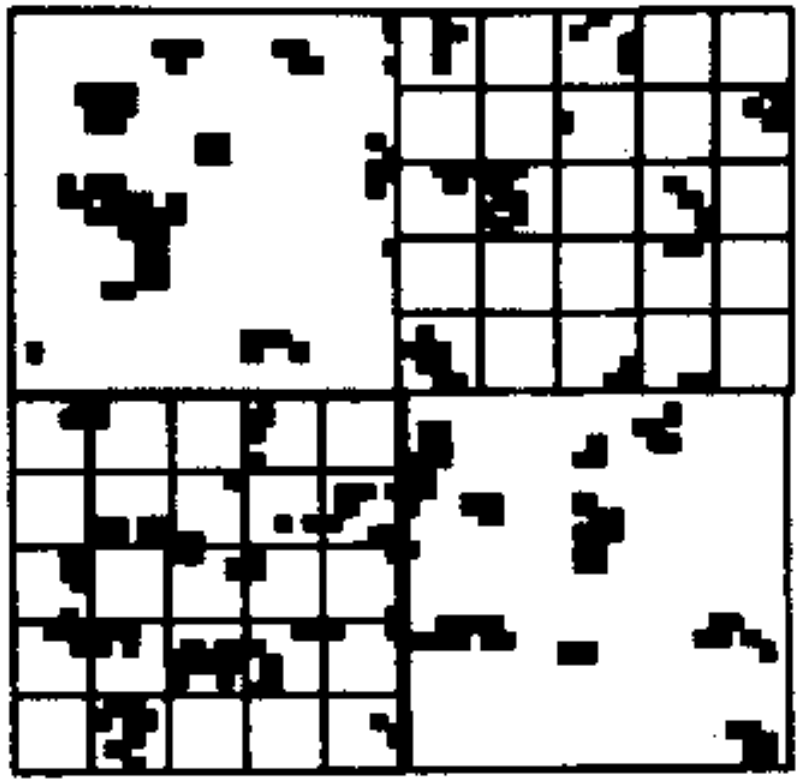
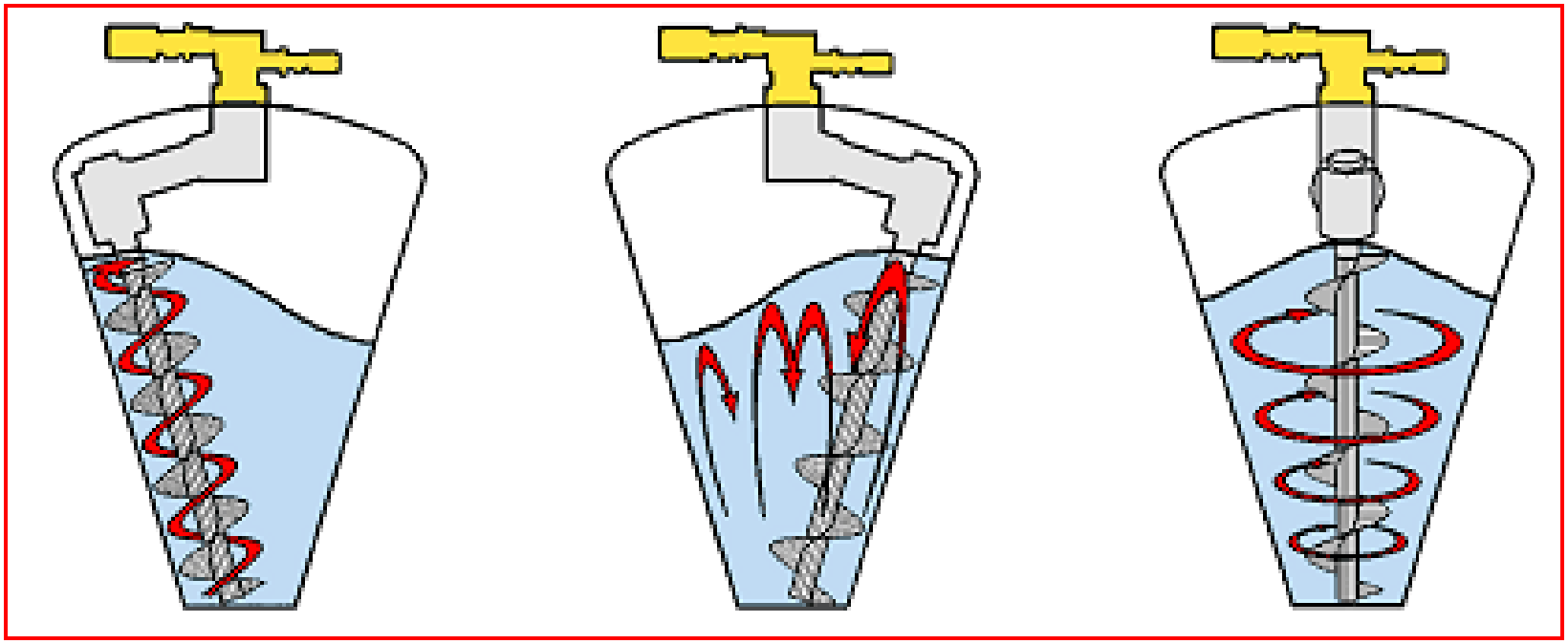


CONVECTION



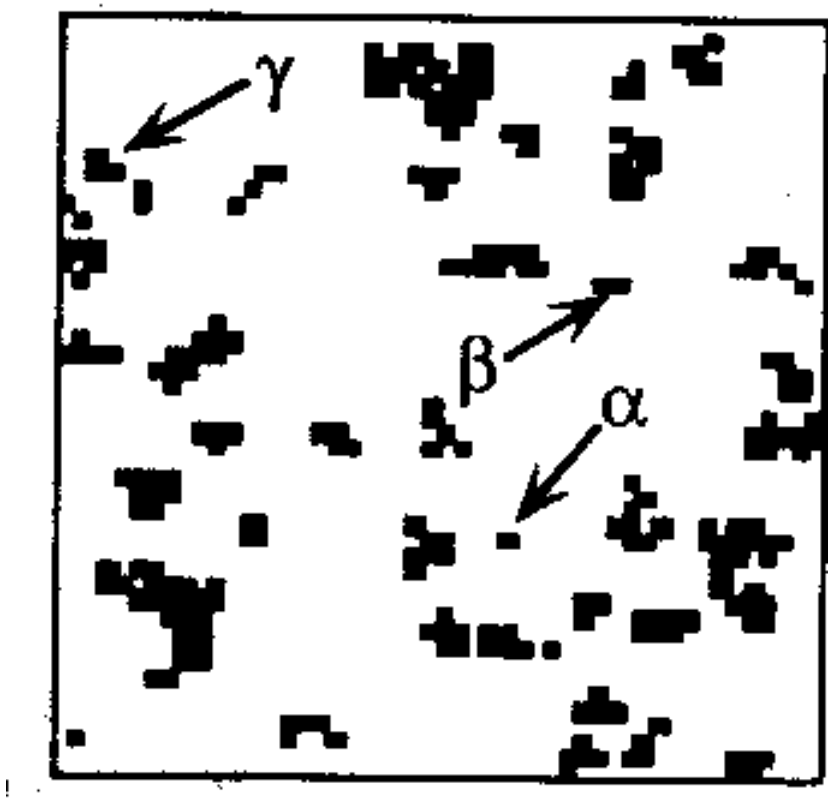
NAUTA MIXER

NAUTA MIXER



RIBBON BLENDER

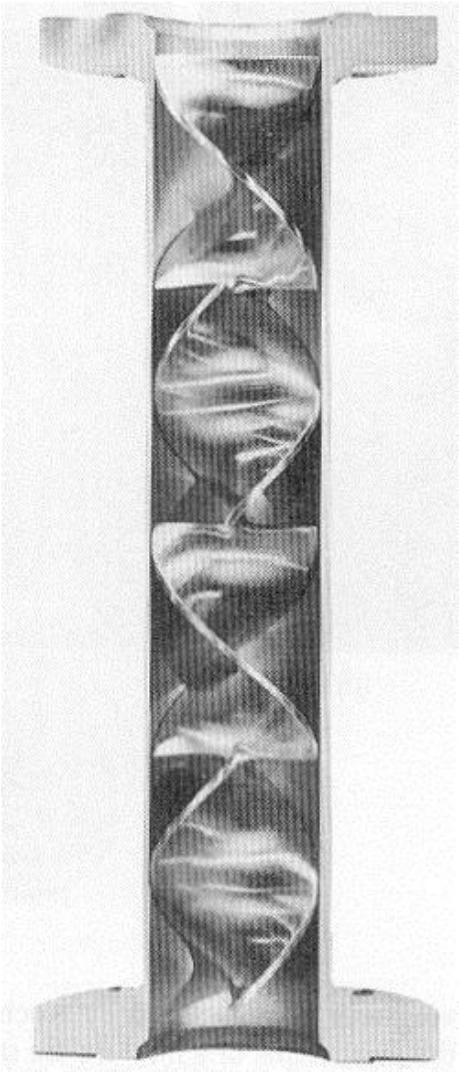
SHEAR DISPERSION



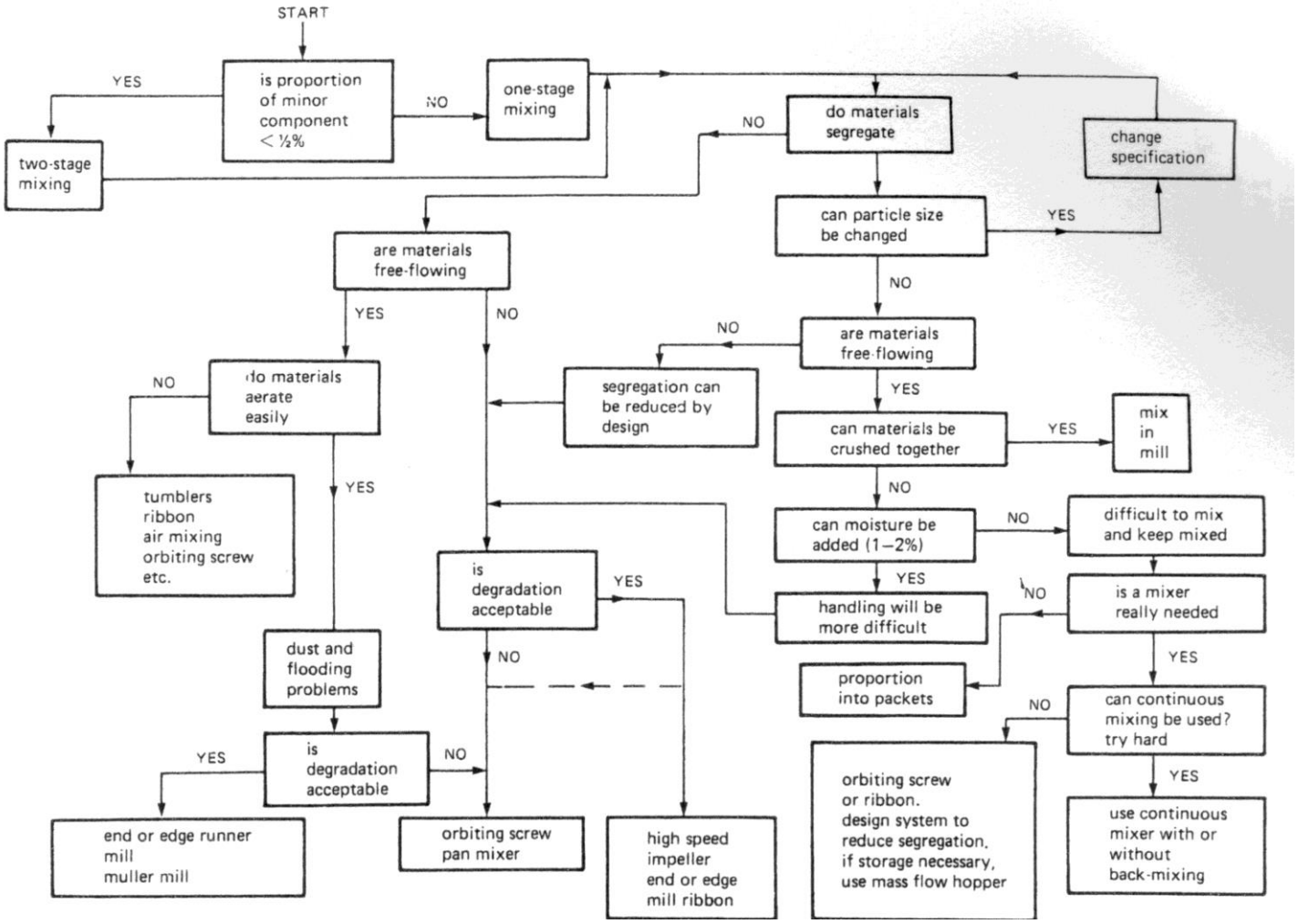
SHEAR DISPERSION

SHEAR DISPERSION

STATIC MIXER



MIXER SELECTION



MIXING STRATEGIES

> 5-10% → Direct blending

1-5% → Preblending (non-geometric)

<1% → Preblending (Geometric)

< 0.1% → Solvent addition or Ordered mixing

PREBLENDING (NONGEOMETRIC)

Use $KC^{0.5}$

Example: 4% loading

$0.04^{0.5}$=20%, preblend 1 part in 4 parts and subsequently make final blend

PREBLENDING (GEOMETRIC)

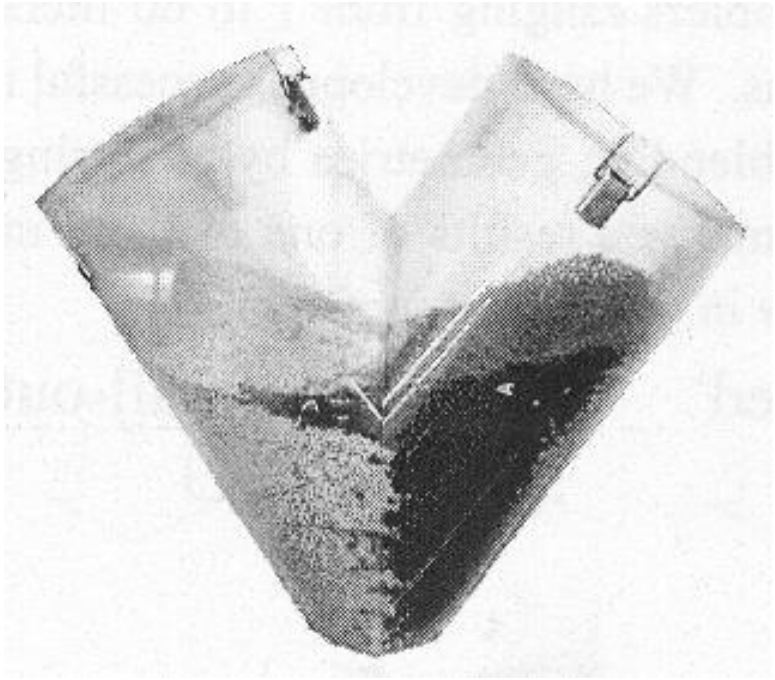
Mix equal parts of key component and other component (→ Mixture 1)

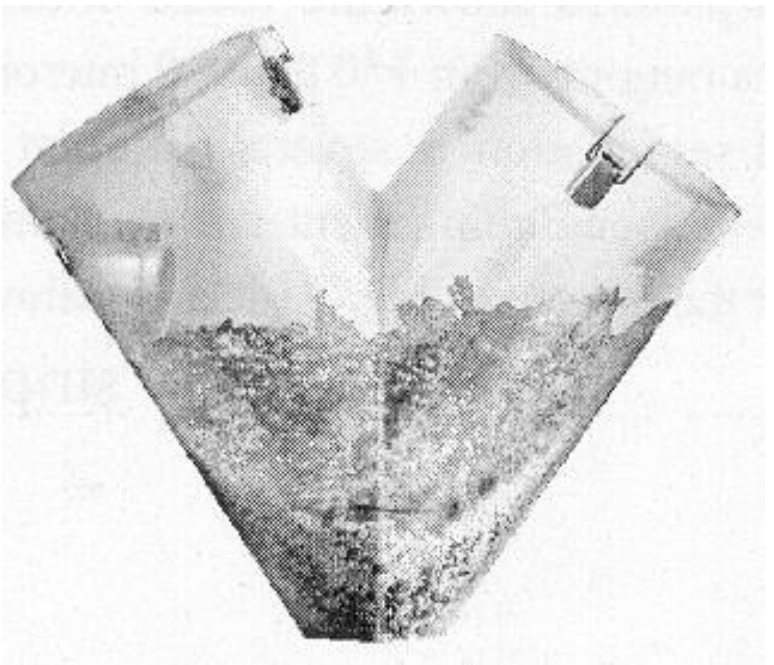
Mix equal parts of Mixture 1 and other component (→ Mixture 2)

Mix equal parts of Mixture 2 and ….

….

SEGREGATION





SAMPLING

Powder should be in motion when sampled

Better sample the whole stream for many short times than part of the stream for a long time

Use revolving sample splitter for reduction

SAMPLE SPLITTERS

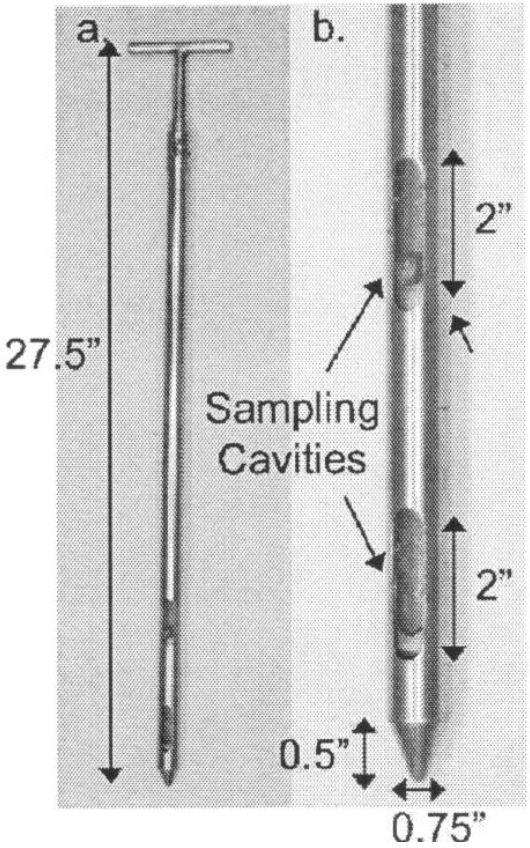
Method	rsd [%]
cone and quartering	6.81
scoop sampling	5.14
table sampling	2.09
Chute riffler	1.01
Spinning Riffler	0.125

SAMPLE THIEVES

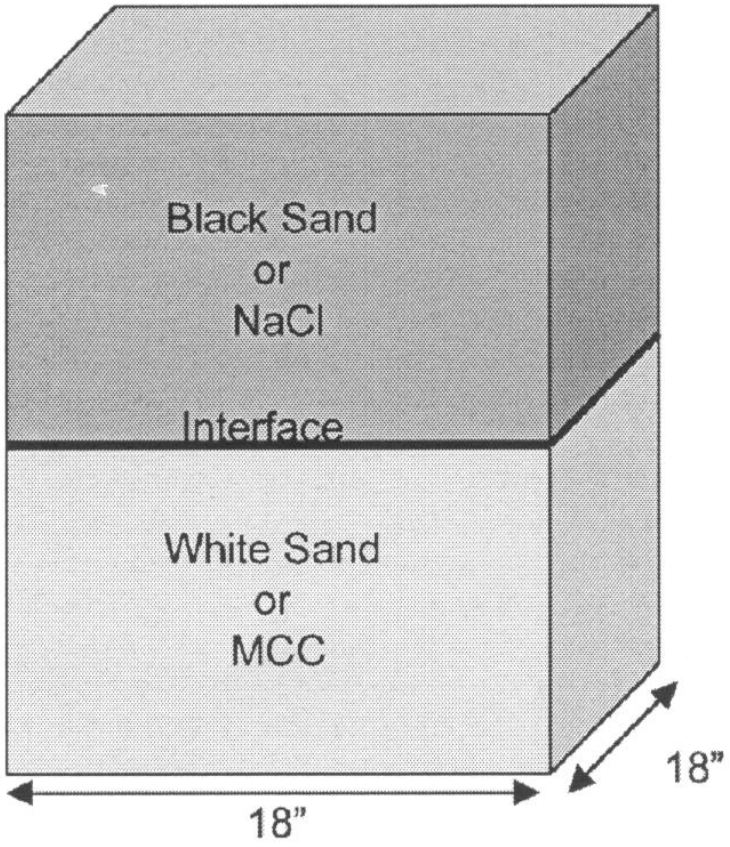
Several different designs are available

Accuracy varies strongly, not only between different designs but also in one design between different mixtures!

A SAMPLE THIEF



TEST THE THIEF



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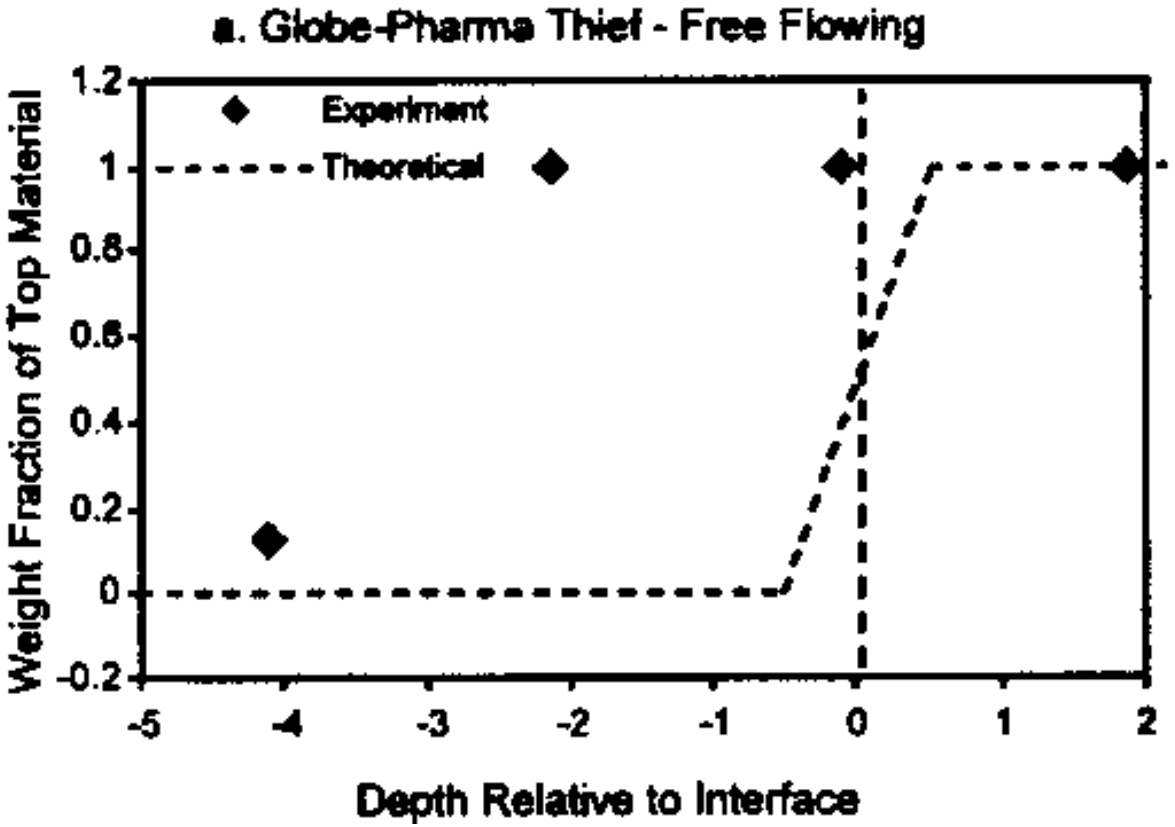

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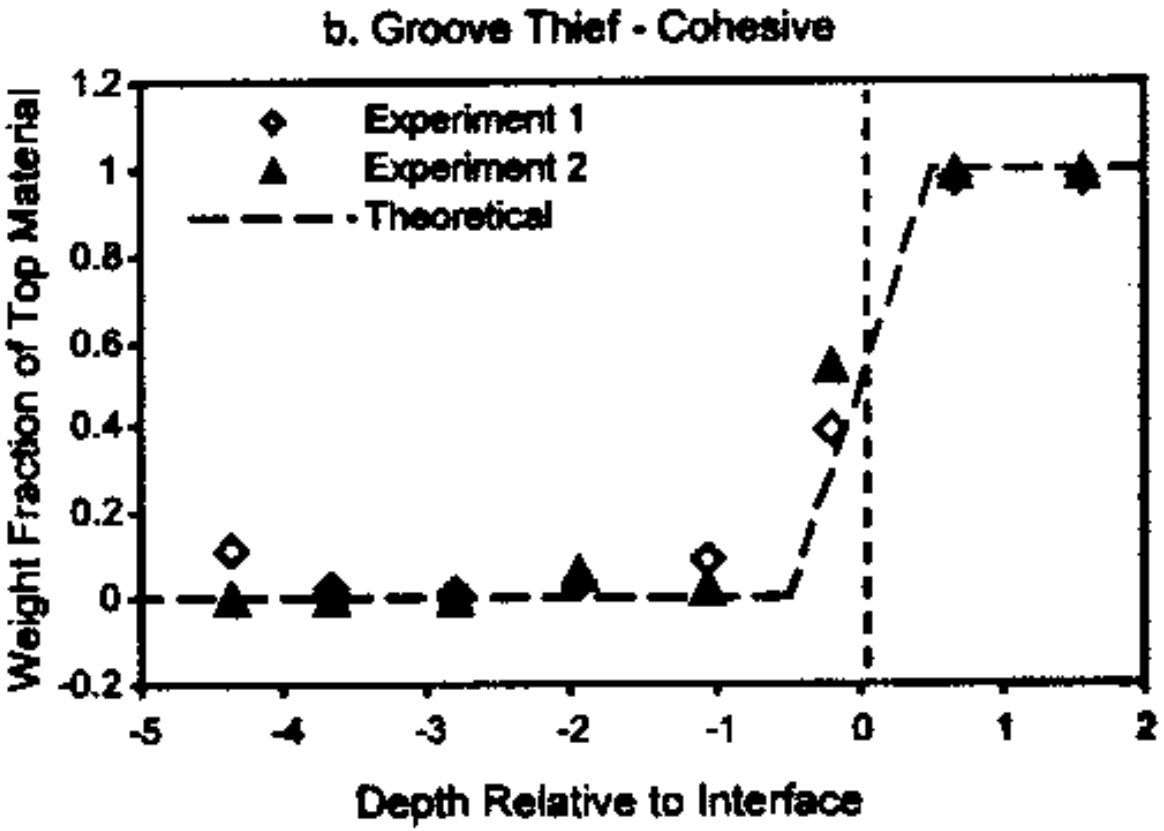

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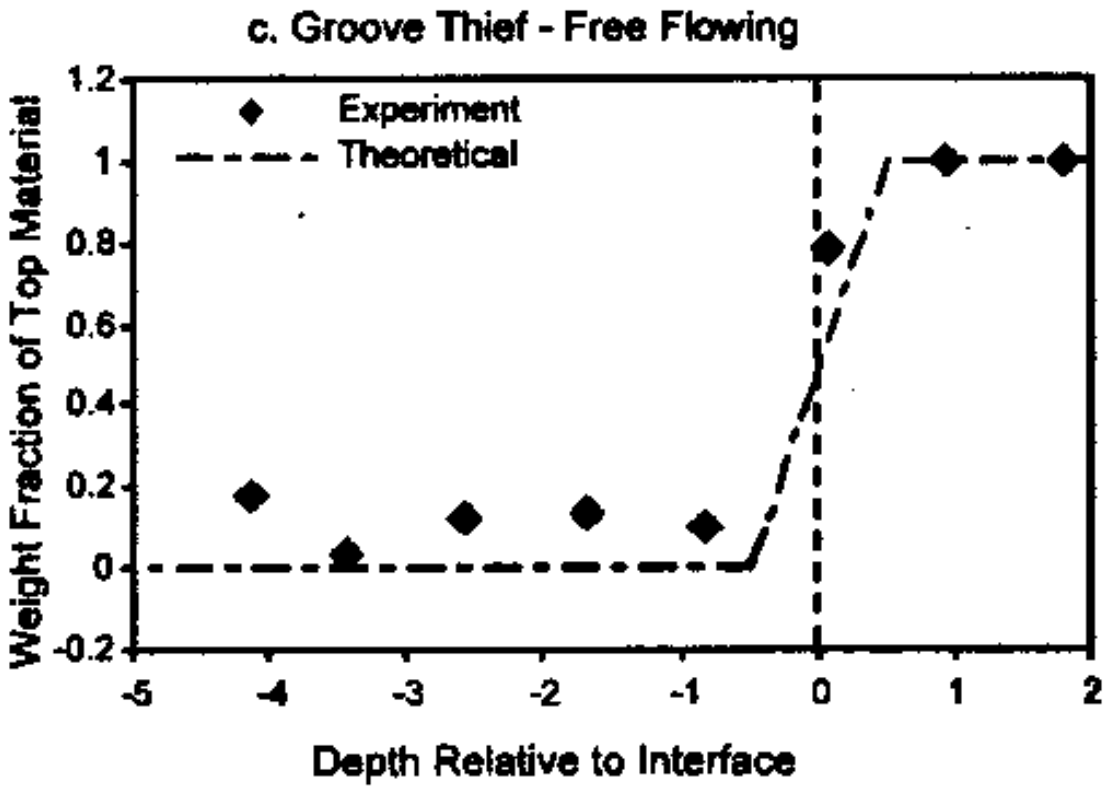
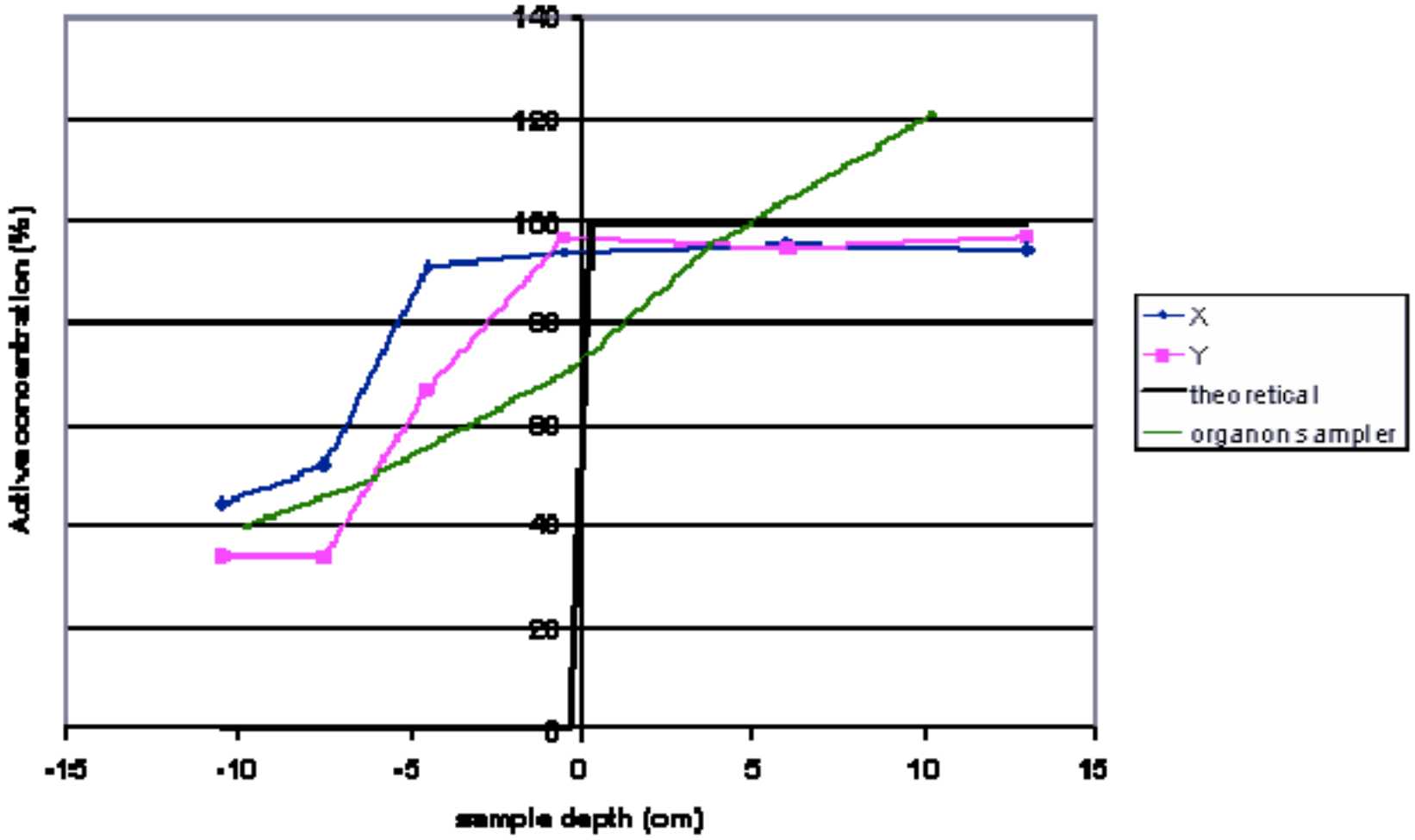


LOW DOSED PRODUCT (3%)



USE THE THIEF

Consistent and standardized technique

- Angle of insertion
- Swivel
- Fast or slow
- Personnel training

Glass vs plastic containers (static)

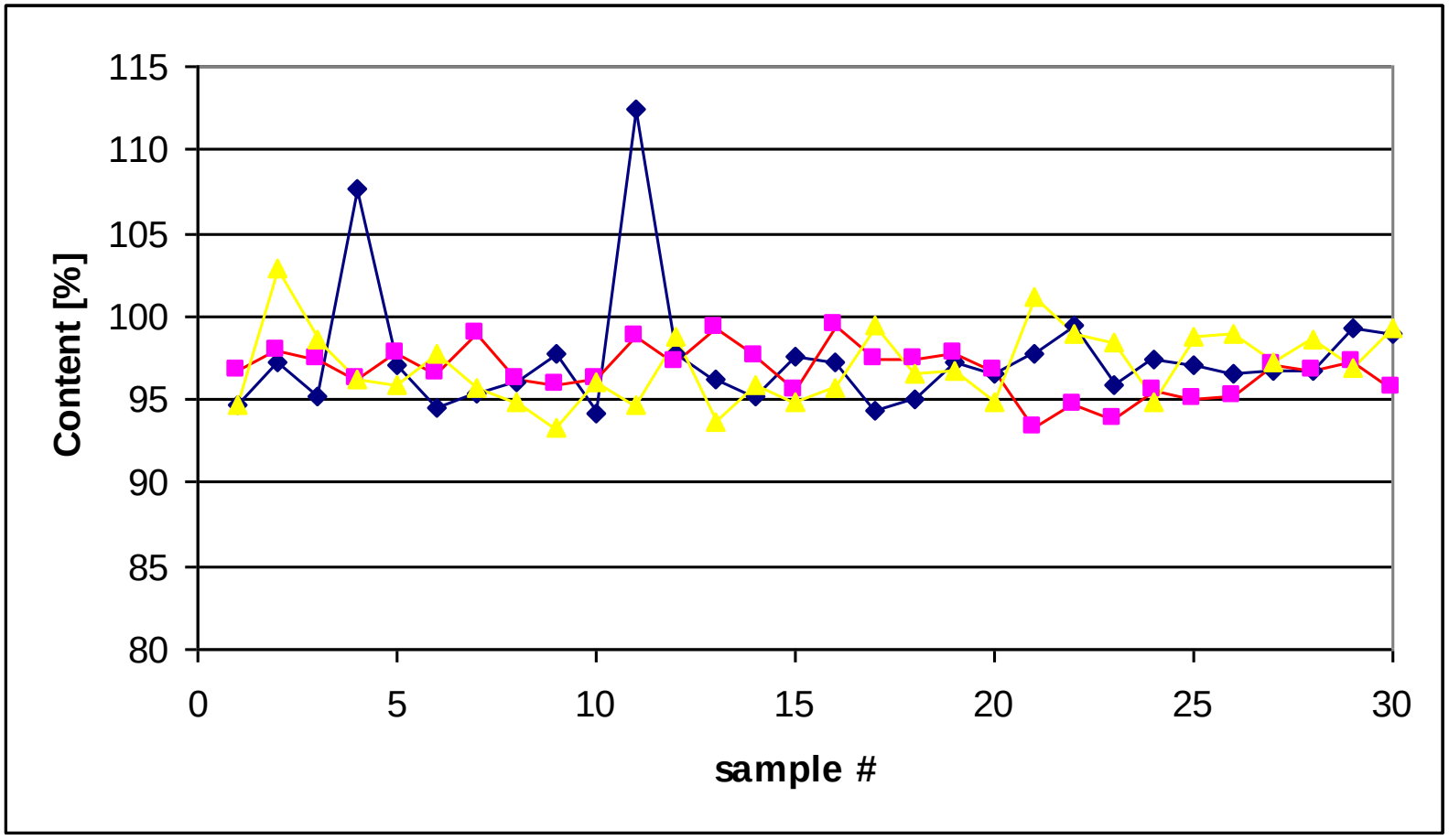
Test entire sample

Weigh sample containers before sample is added

Rinse sample container with extra diluent

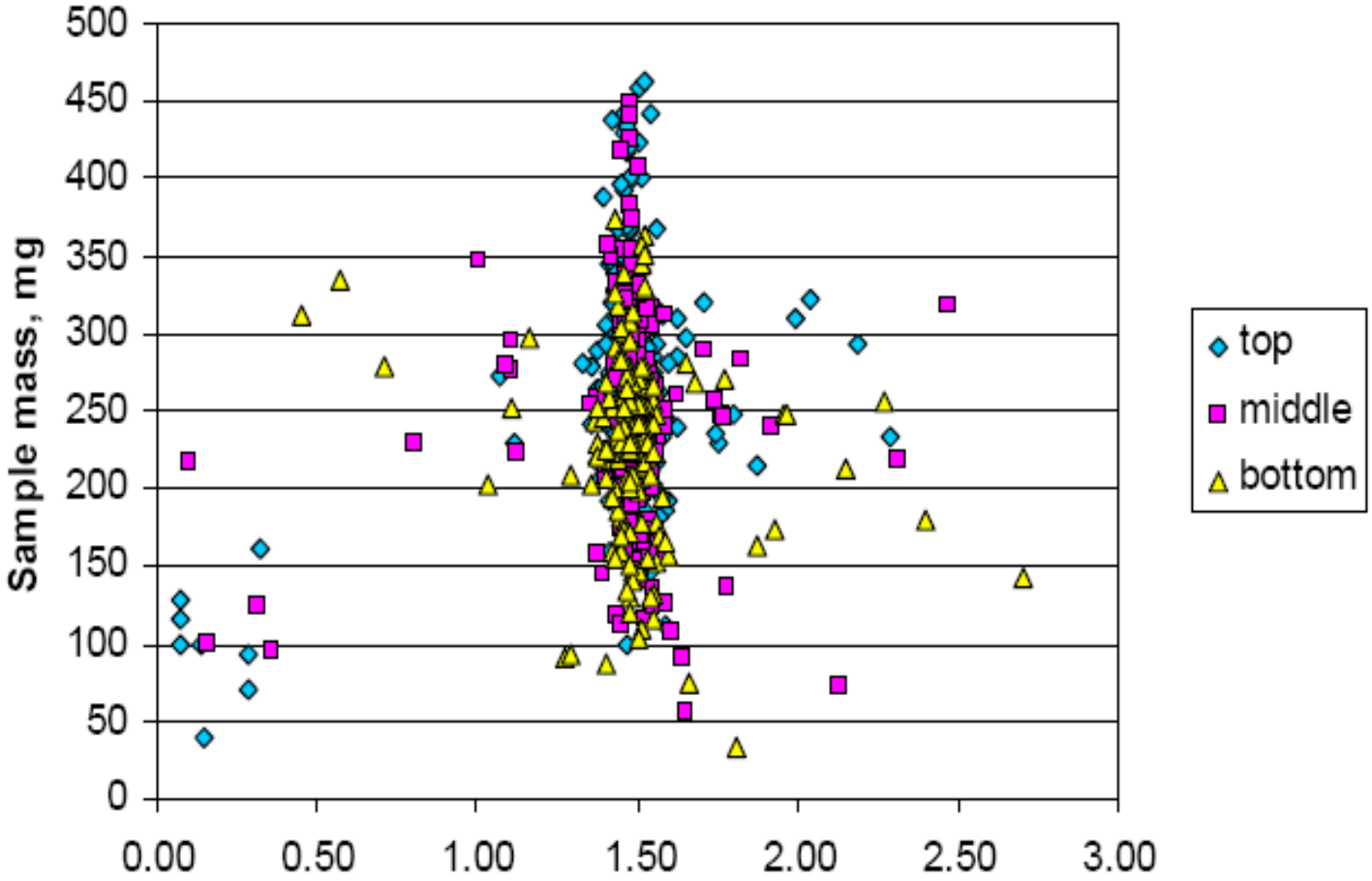
Lab training

BLEND SAMPLING

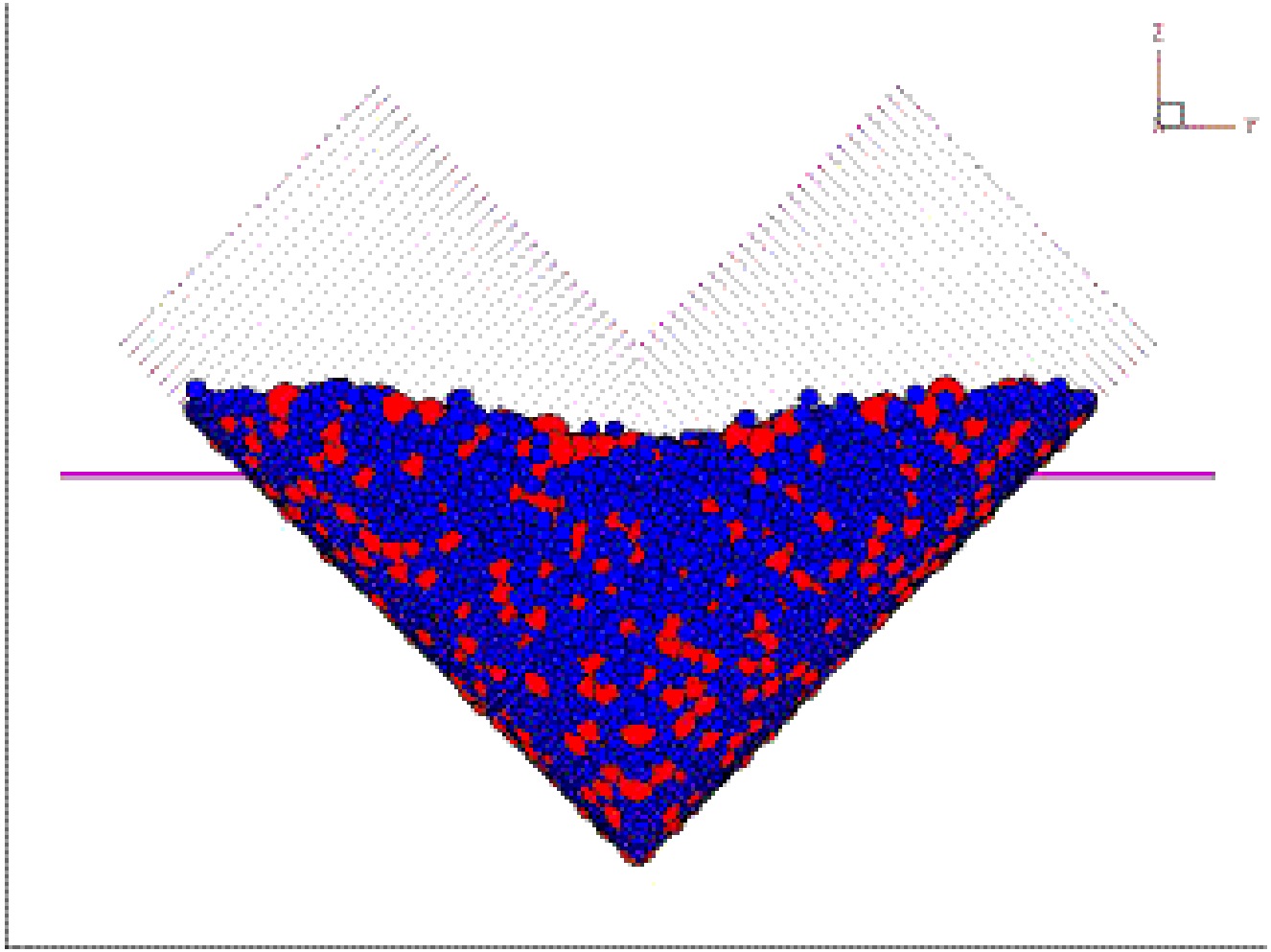


P/T: 60%

BLEND SAMPLING



THE TIME FACTOR



Abbott