

# Mixing of Powders

## Objective:

To study the process of mixing and see how the properties of ingredients - the particle size distribution as example - will affect the process. Also investigate the effect of mixing time, and mixing speed on the state of mixing.

## Equipment:

The unit is composed of a double-cone mixer, with a timer, and with a speed controller.

Samples can be analyzed by an ionselective meter, or by titration method.

## Theory:

The mixing index is a measure of how far mixing has proceeded toward equilibrium.

For granular solids, the mixing index is defined as  $I_s = \frac{\sigma_e}{S}$  the equilibrium standard deviation for complete mixing over standard deviation

$$I_s = \frac{\sigma_e}{S} = \frac{\mu_p \cdot 1 - \mu \cdot (N - 1)}{n \sum_{i=1}^N (x_i - \mu)^2}$$

where:

$\mu_p$ : is the overall fraction, by number of particles, of sand in the total mix.

N: is the number of spot samples.

n: is the number of particles in the sample.

$x$  : Fraction of sand in each spot sample.

$\mu$  : Average fraction of sand in all spot samples.

### **Procedure:**

1. Weigh certain amount of salt and sand as instructed, and load the material to the mixer.
2. Fix the speed of the mixer and run it.
3. After 5 minutes of running, stop the mixer and take 3-5 samples from different locations of the mixed material and place in sample bottles.
4. Start running the mixer again and repeat taking samples after 10, 15, 20, 30, 45, and 60 minutes.
5. Using the ionselective meter (or any analytical method), the weight of salt as well as sand in each sample taken can be found.
6. Repeat using one of the variables below:
  - a. Speed of rotation.
  - b. Moisture or liquid content of solids.
  - c. Relative amounts of components.

### **Calculation:**

1. Calculate the mixing index for each spot sample.
2. Draw graph of mixing index against the variable selected.

### **References:**

1. Coulson and Richardson," Chemical Engineering ", Vol.II,Pergamon Press
2. McCabe and Smith," Unit Operation of Chemical Engineering ", 3rd edition.

## Mixing of Powder Data Sheet

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Weight of salt: \_\_\_\_\_

Particle size of salt: \_\_\_\_\_

Weight of sand: \_\_\_\_\_

Particle size of sand: \_\_\_\_\_

Time	Sample Location	Sample wt(g)	Vol. of AgNO <sub>3</sub> (ml)
5 min	Top		
	Bottom		
	Right		
	Left		
10 min	Top		
	Bottom		
	Right		
	Left		
15 min	Top		
	Bottom		
	Right		
	Left		
20 min	Top		
	Bottom		
	Right		
	Left		
30 min	Top		
	Bottom		
	Right		
	Left		
45 min	Top		
	Bottom		
	Right		
	Left		
60 min	Top		
	Bottom		
	Right		
	Left		

Instructor signature:

Date: