



Soy Excellence Center SEC Feed Manufacturing Track – Basic Level



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Batching and Mixing System

Patrick Clark, PhD

Two Independent Processes

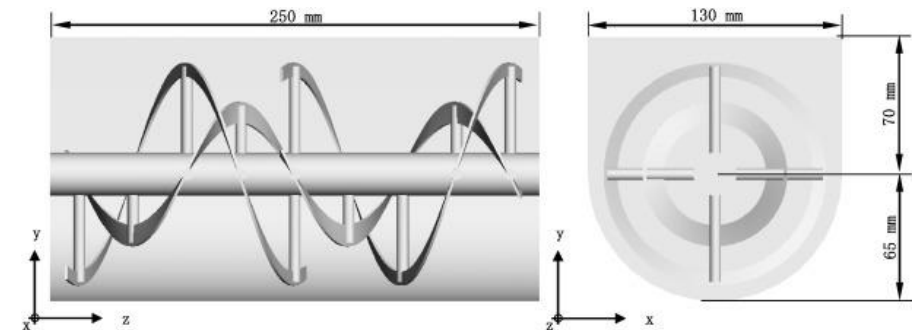
Batching

- Weigh each ingredient accurately
 - Weighing ingredients
 - Manually
 - Automatically
 - Both



Mixing

- To produce feed in which nutrients and medications are uniformly distributed at the lowest time





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Importance

Highly important during the starter period due to lower feed intake



12 g/day

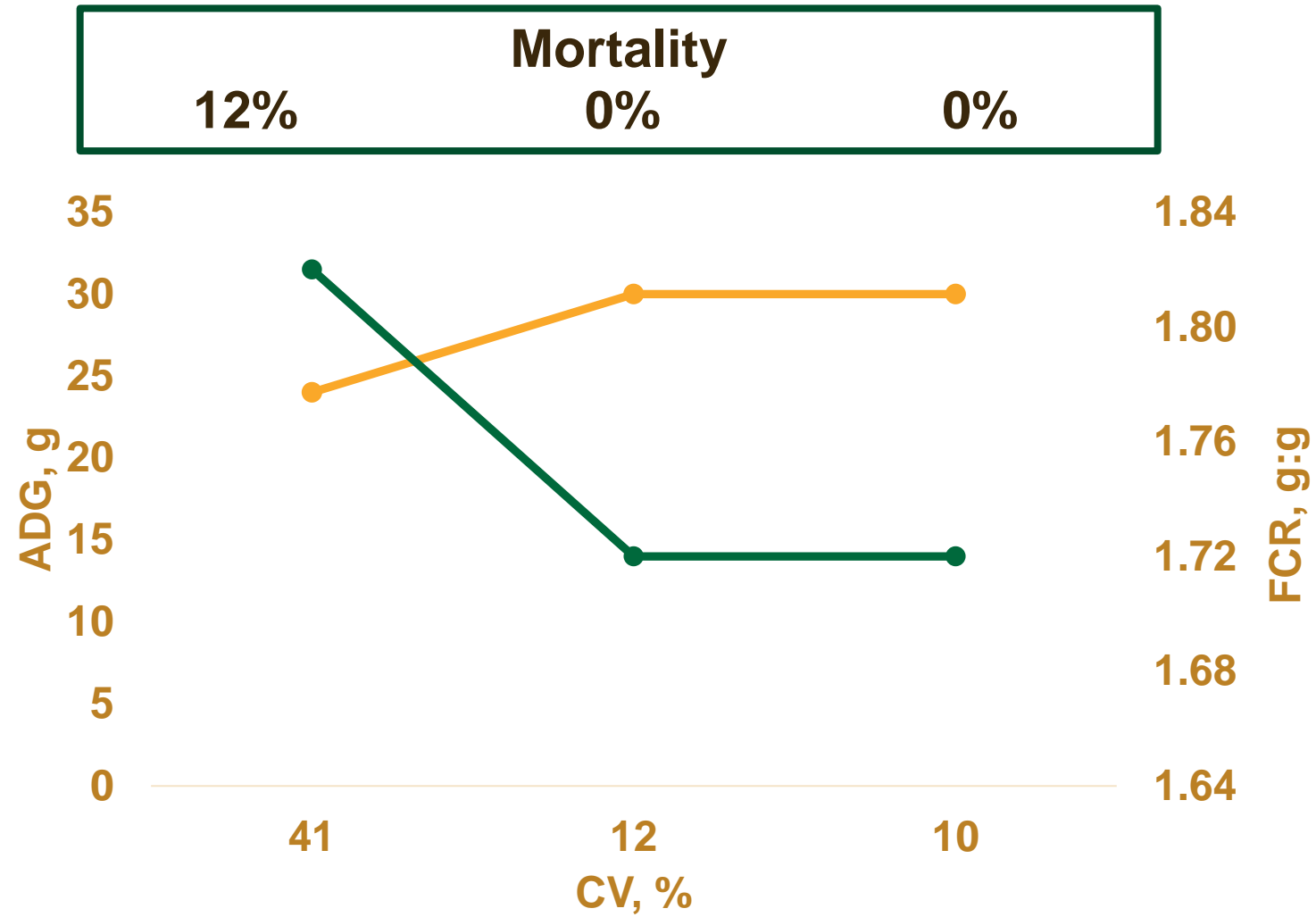


220 g/day



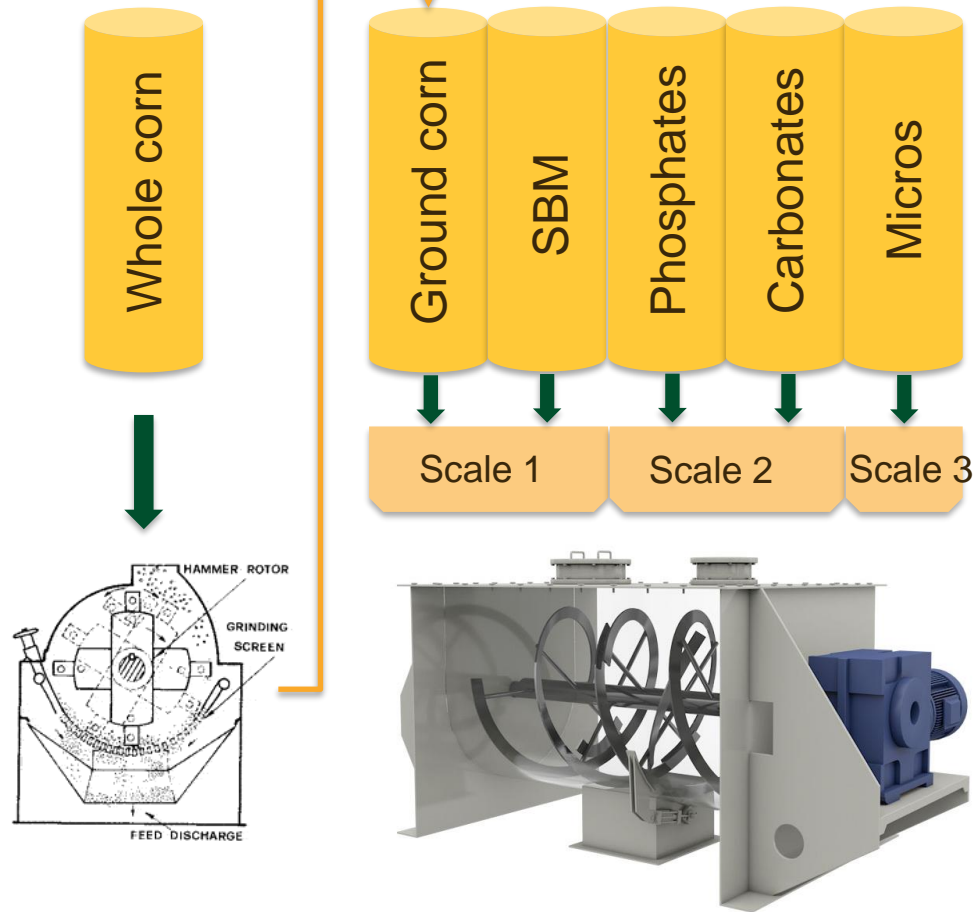
>1000 g/day

Importance

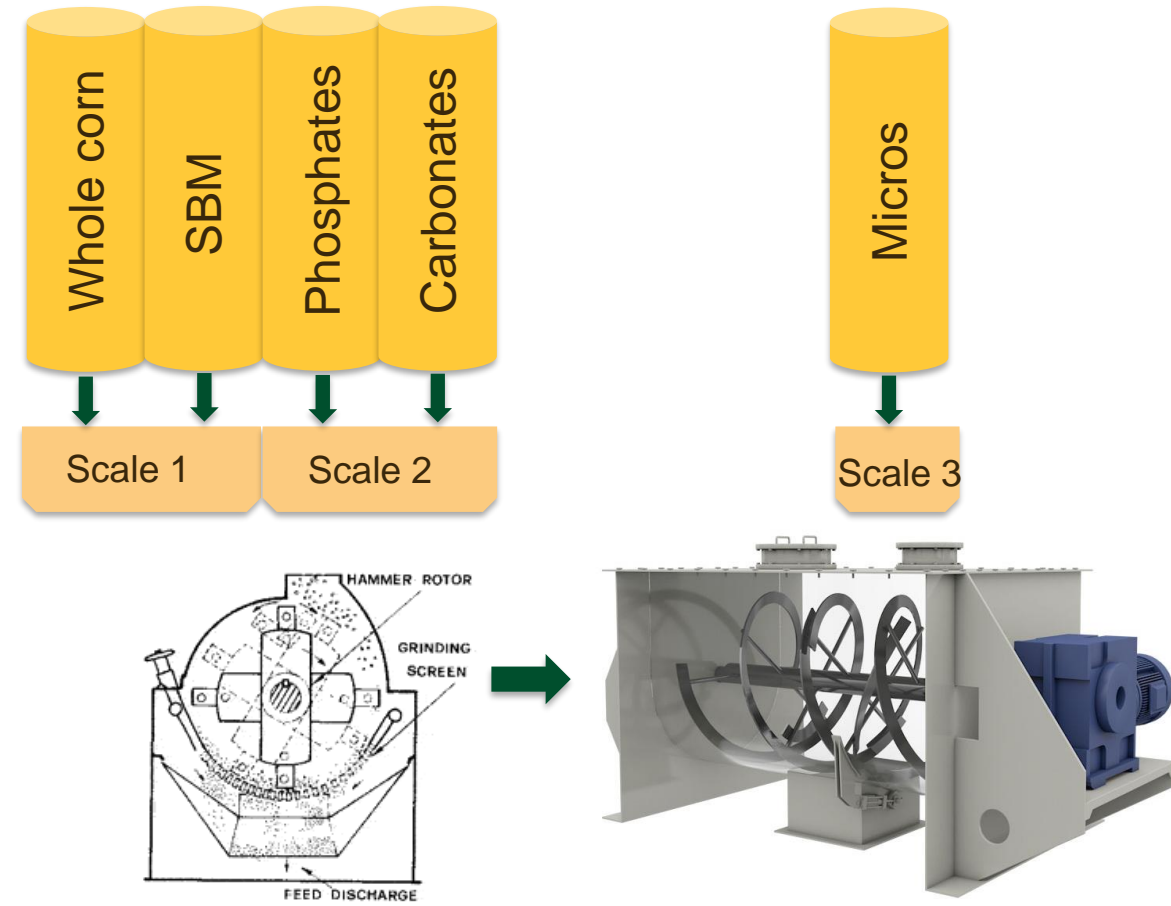


Feed Mill Design

Pre-Grinding



Post-Grinding



Batching Components



Single Hopper

vs.

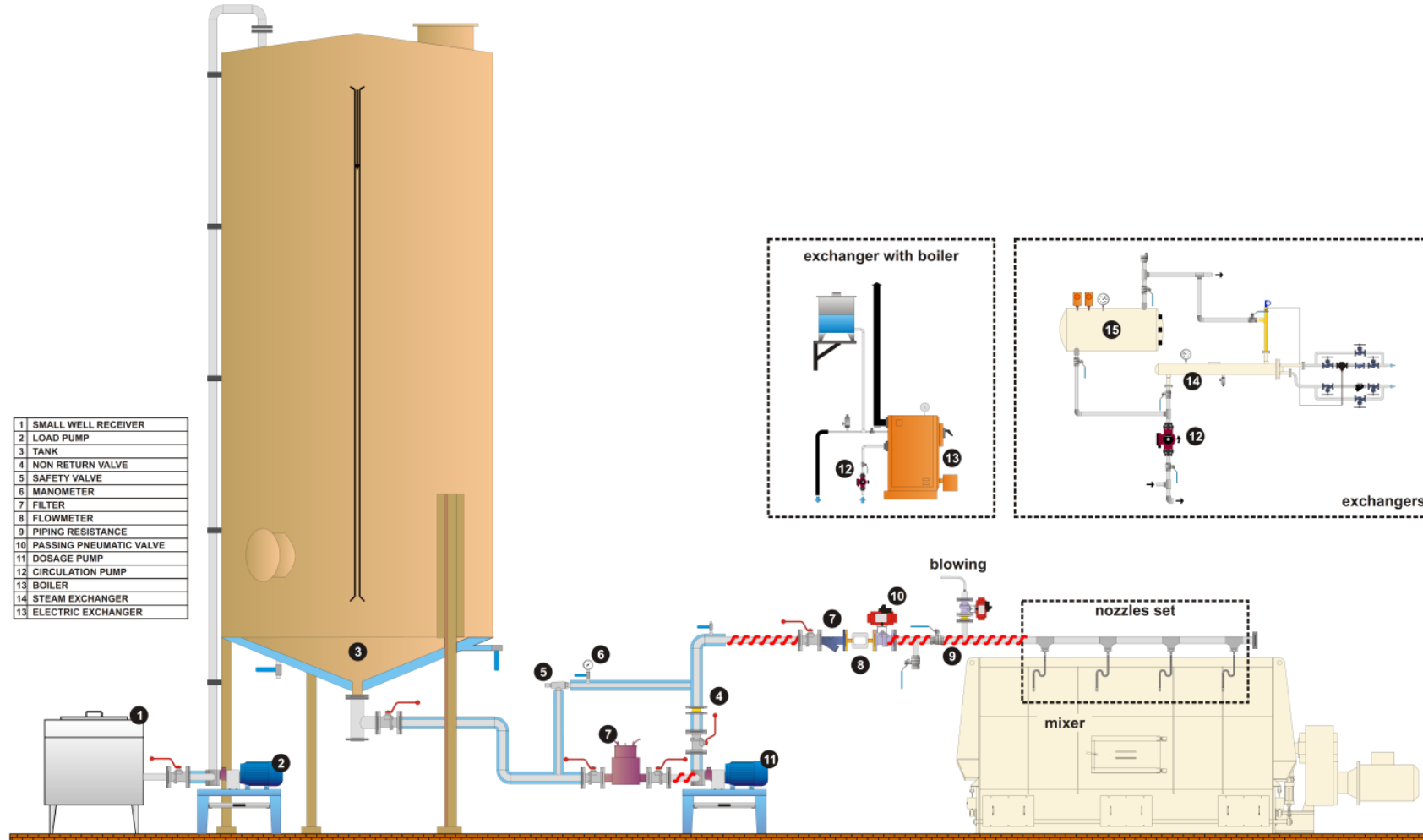
Multiple Hopper



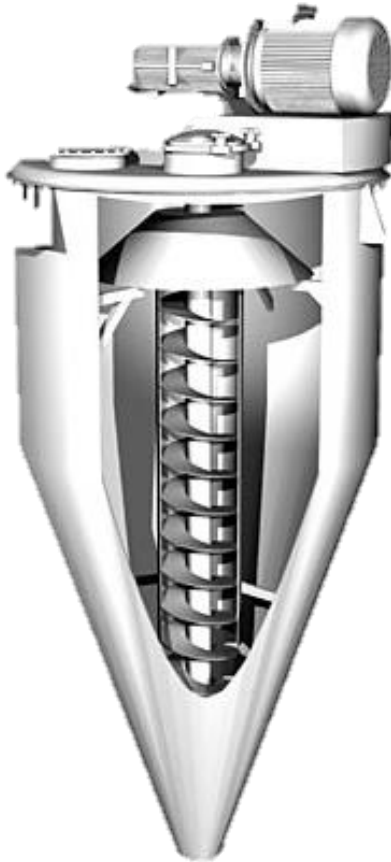
Scale Considerations

- Major – 80 to 90%
- Minor – 10 to 15%
- Micro - <5%
- Scales should be calibrated at installation and certified once a year
 - Scale check can be done “in house” monthly or at least every 3 months

Batching Components

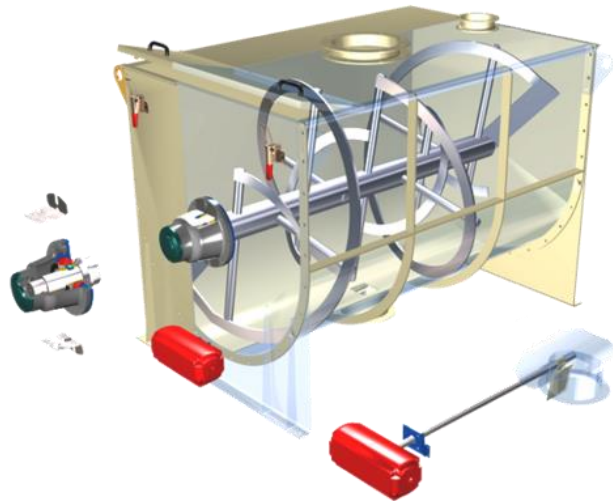


Vertical Mixers



- Advantages
 - Low initial investment
 - Low maintenance cost
 - Small footprint
- Disadvantages
 - > 10 min for mixing
 - Low inclusion of liquids
 - Poor clean out
 - Risk of cross contamination

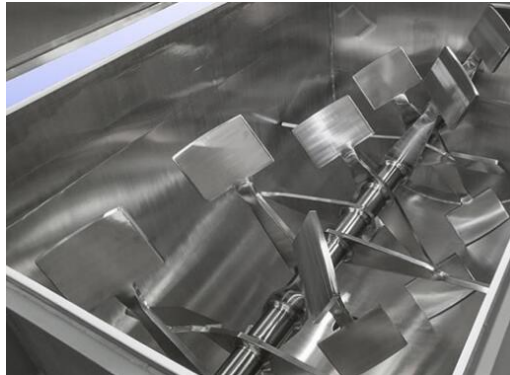
Double Ribbon Mixers



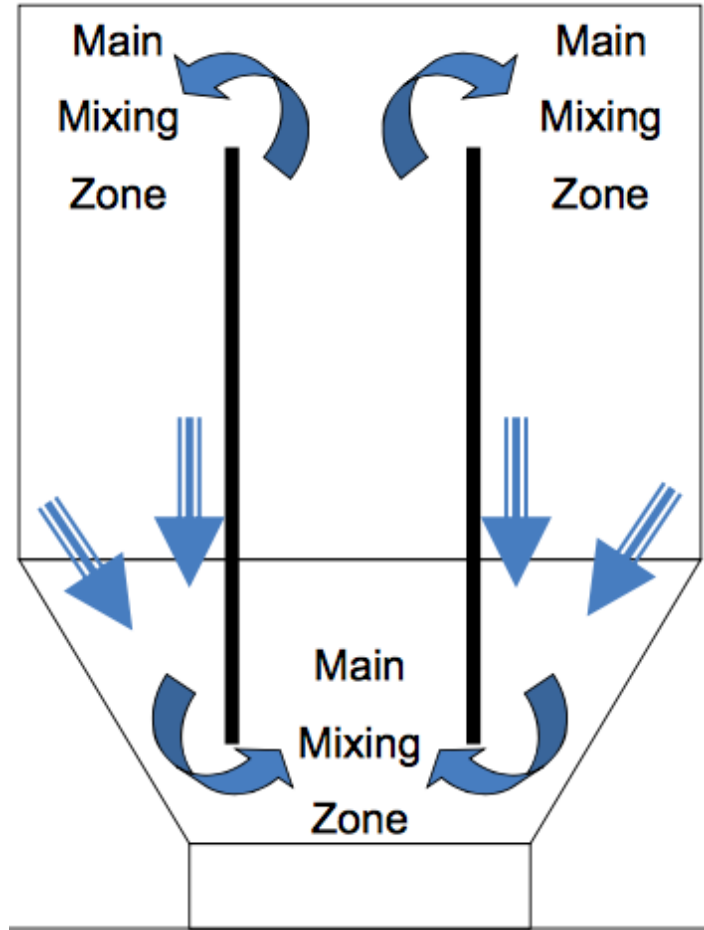
- Advantages
 - ↓ mixing time
 - Higher inclusion of liquids
 - Good clean out
- Disadvantages
 - Higher HP requirements

Paddle Mixers

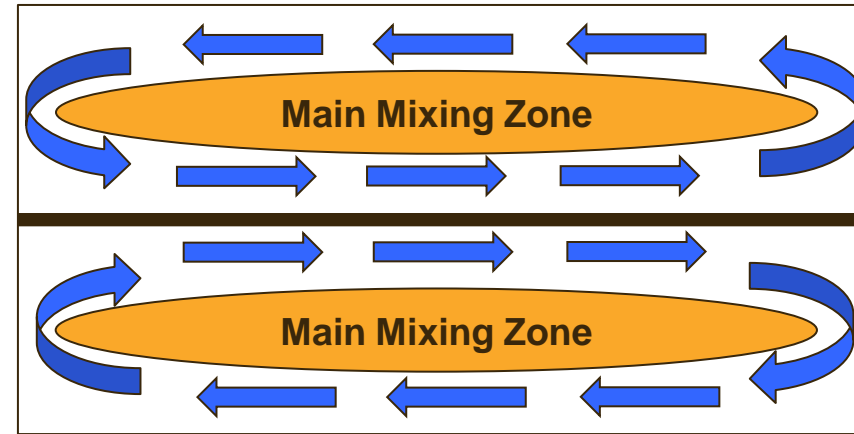
- Paddle mixers are often used in feed mill where there is a high inclusion level of fibrous ingredients or liquids
 - Less surface, which reduce build up inside the mixer
 - Easier to clean



Mixing Zones



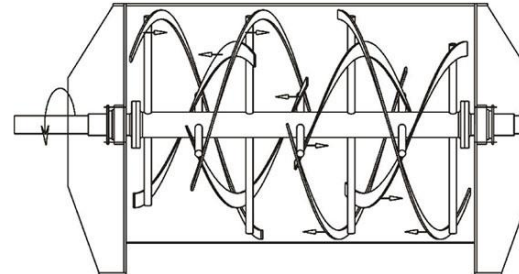
Horizontal – Single or double ribbon have greater mixing zones than vertical mixers



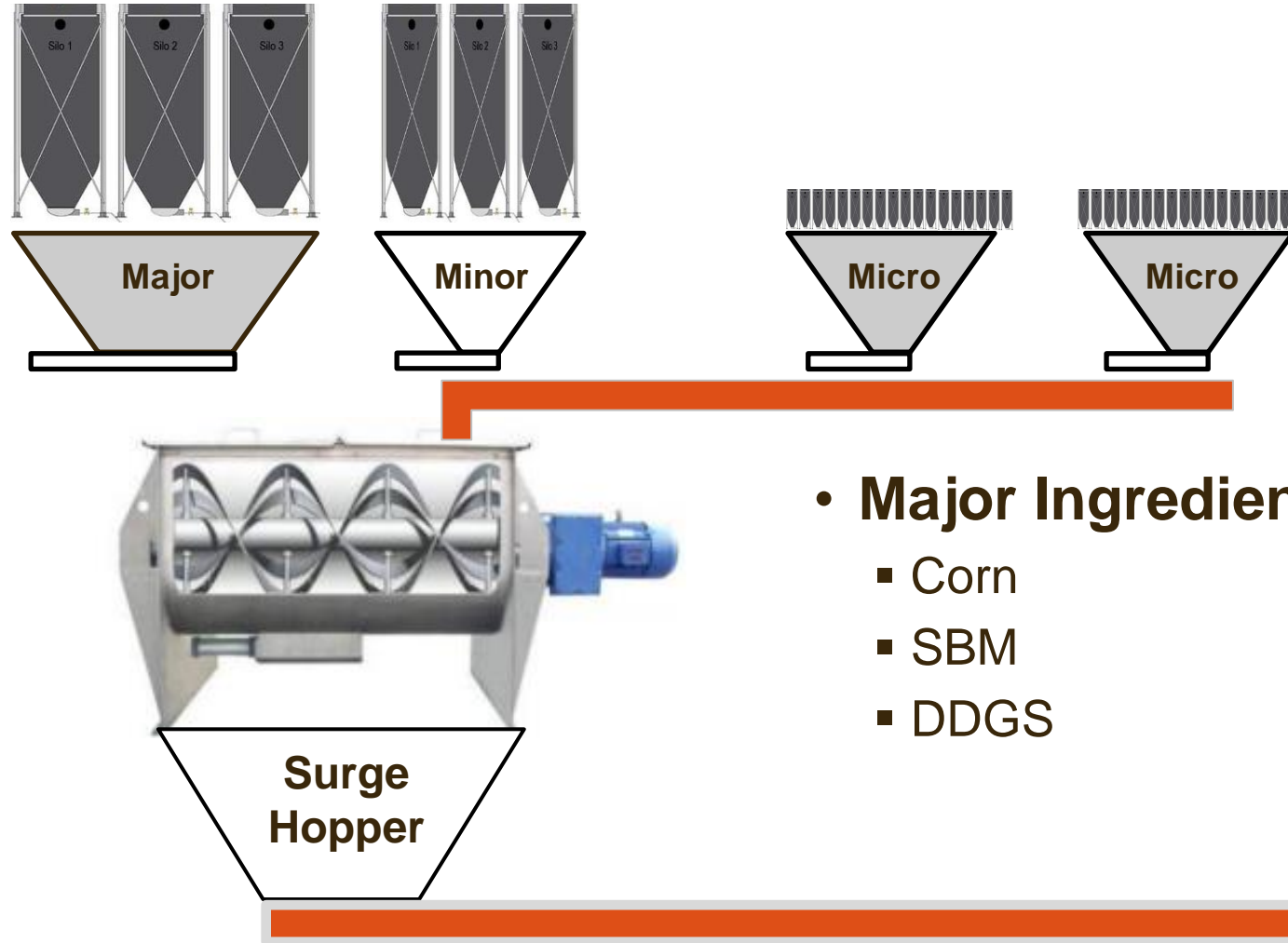
Mixing Times

Mixer Type	Dry cycle, min	Wet cycle, min
Paddle – single shaft	3	3
Double ribbon	1-2	2-3
Counterpoise	0.75-1	2
Vertical	5-10	5-10

Follow you manufacturer recommendations and test mixer uniformity



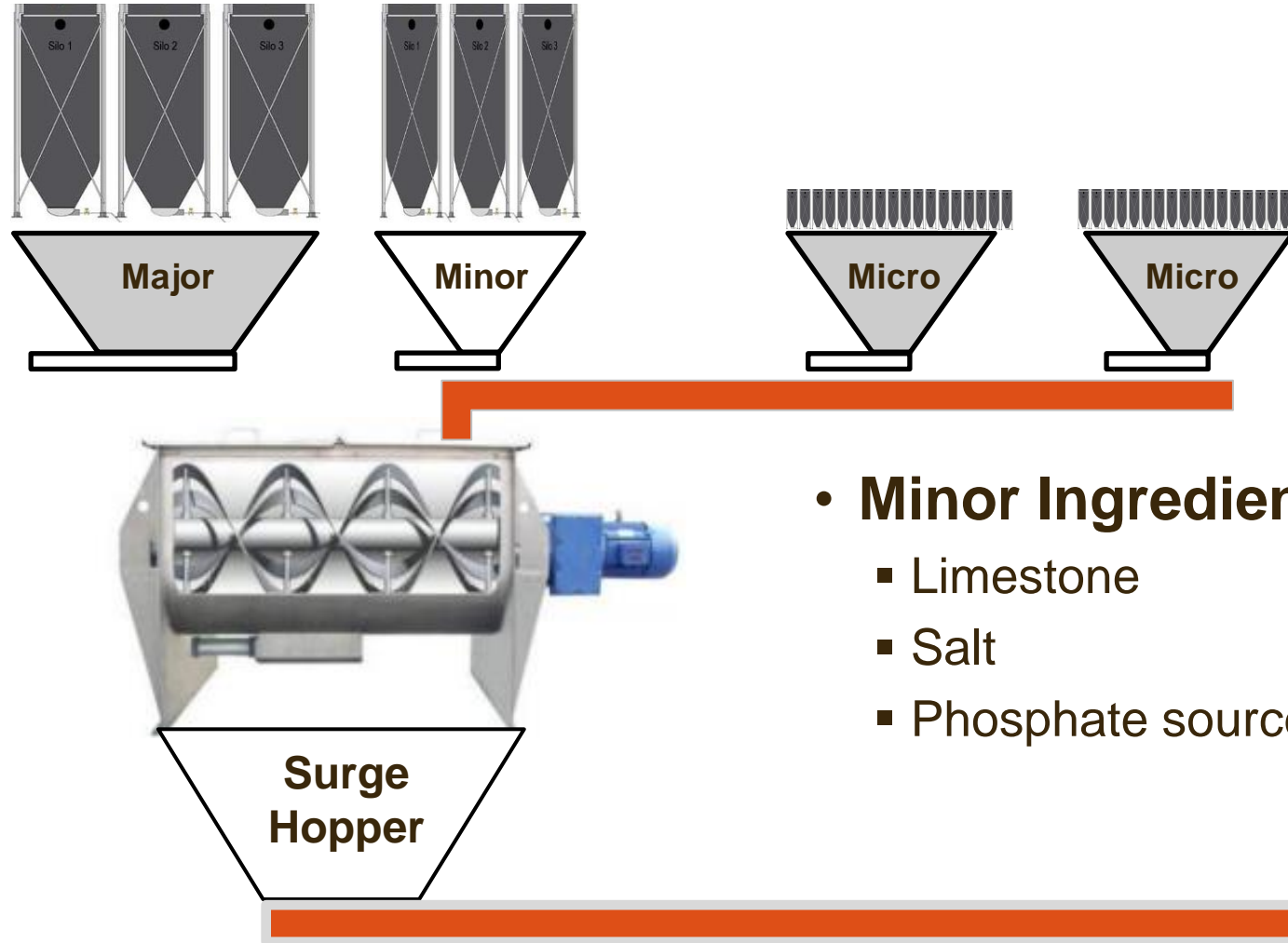
Batching Process



- **Major Ingredients**

- Corn
- SBM
- DDGS

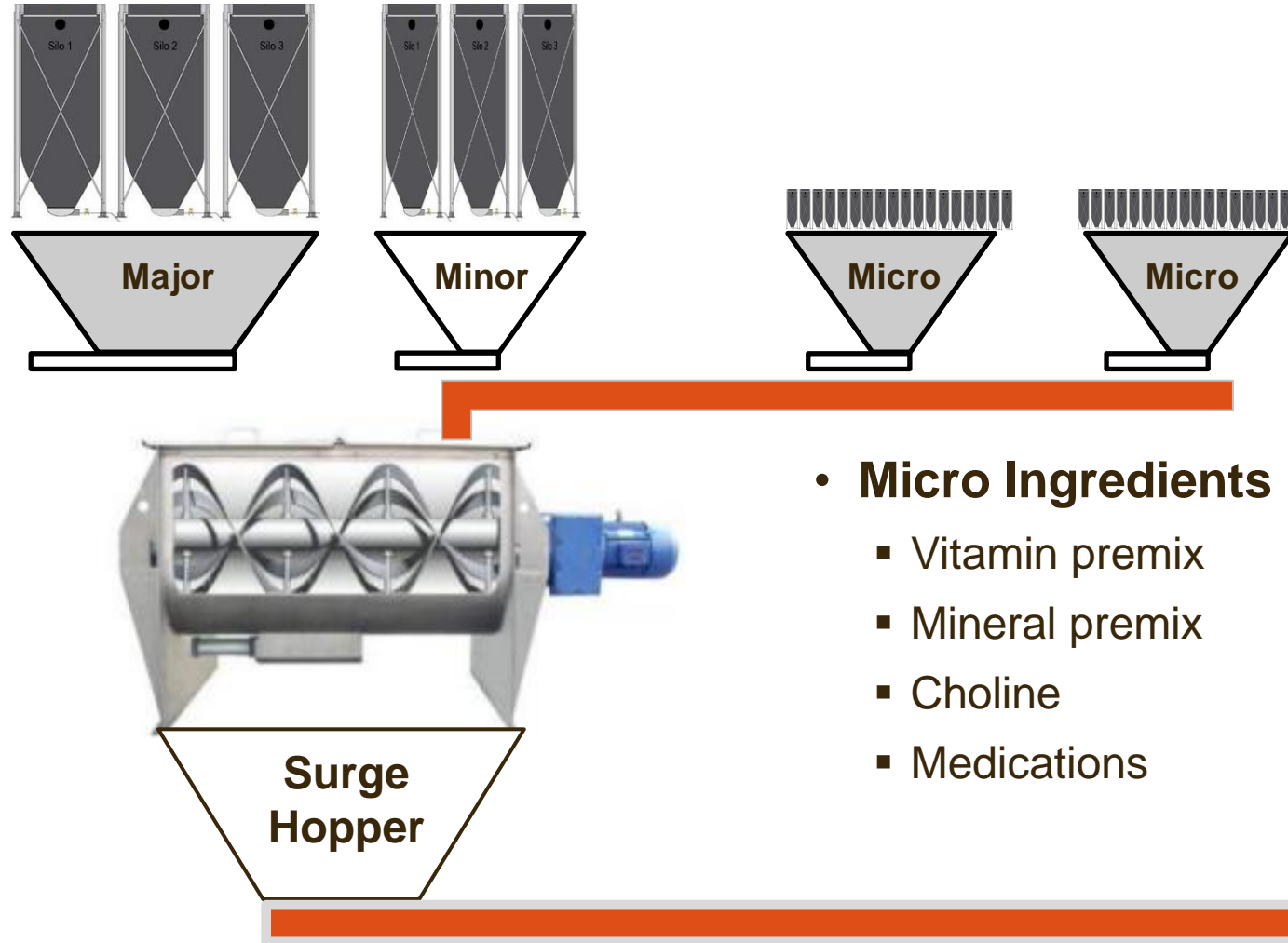
Batching Process



- **Minor Ingredients**

- Limestone
- Salt
- Phosphate sources

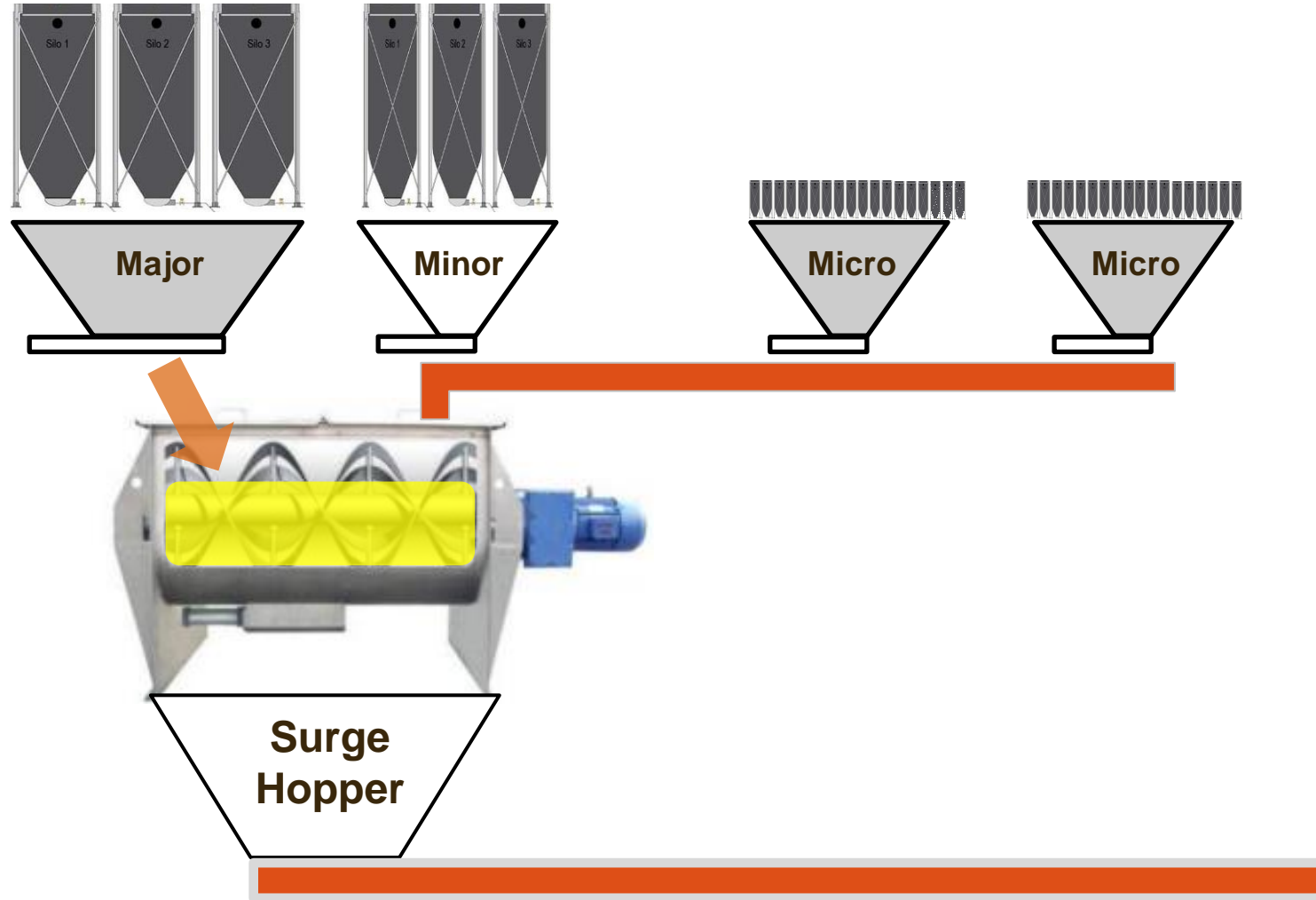
Batching Process



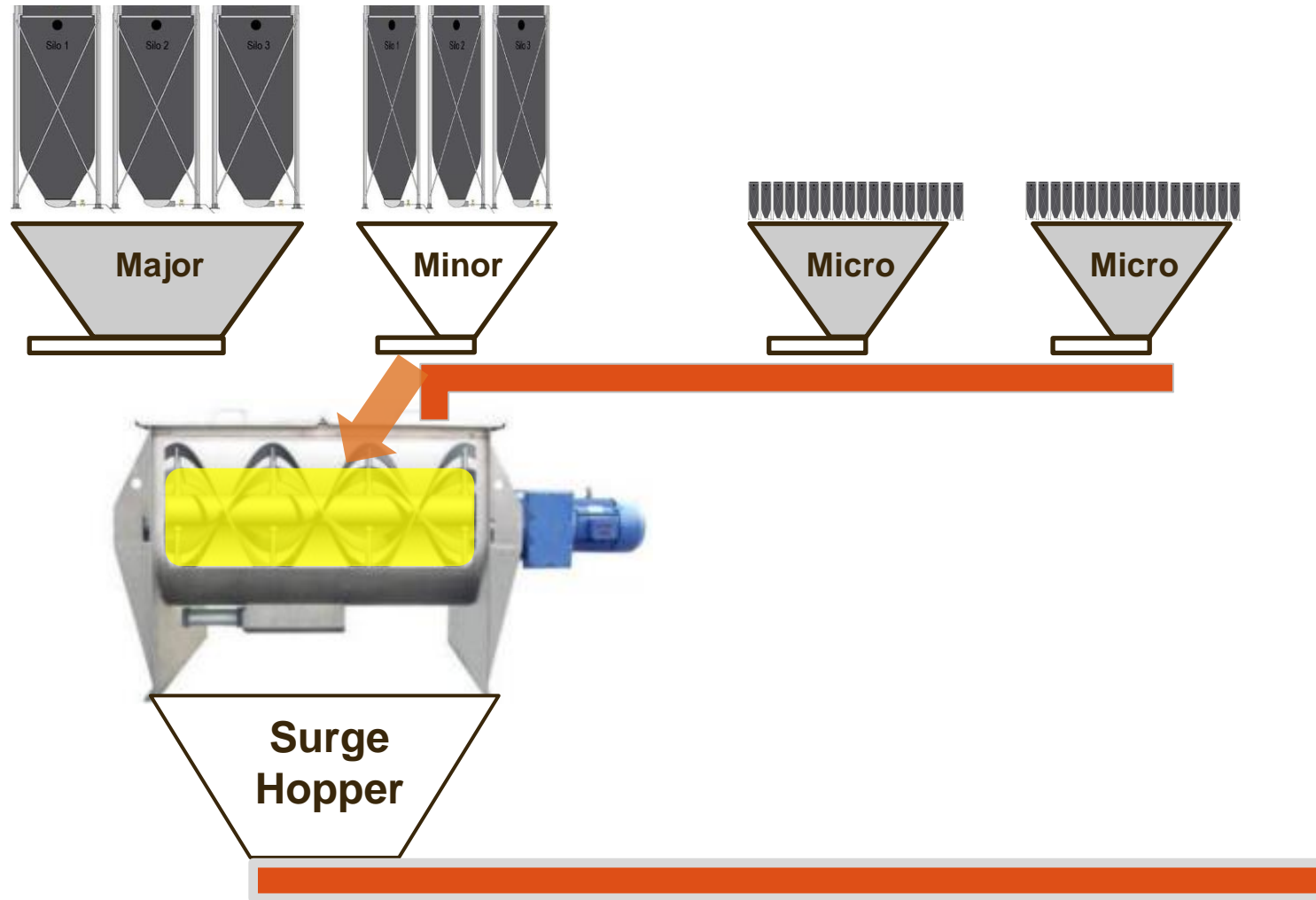
- **Micro Ingredients**

- Vitamin premix
- Mineral premix
- Choline
- Medications

Ingredients Addition



Ingredients Addition





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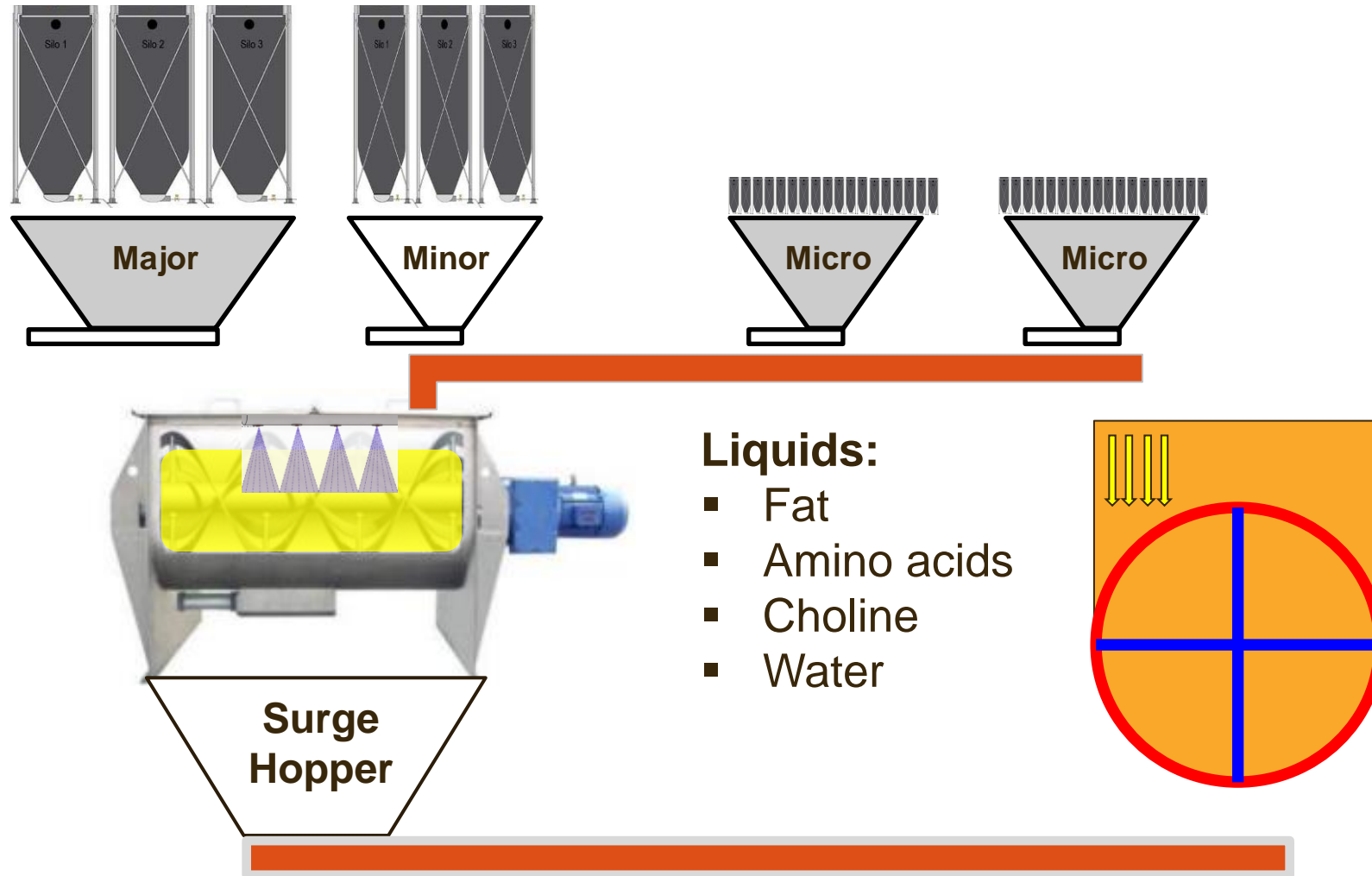
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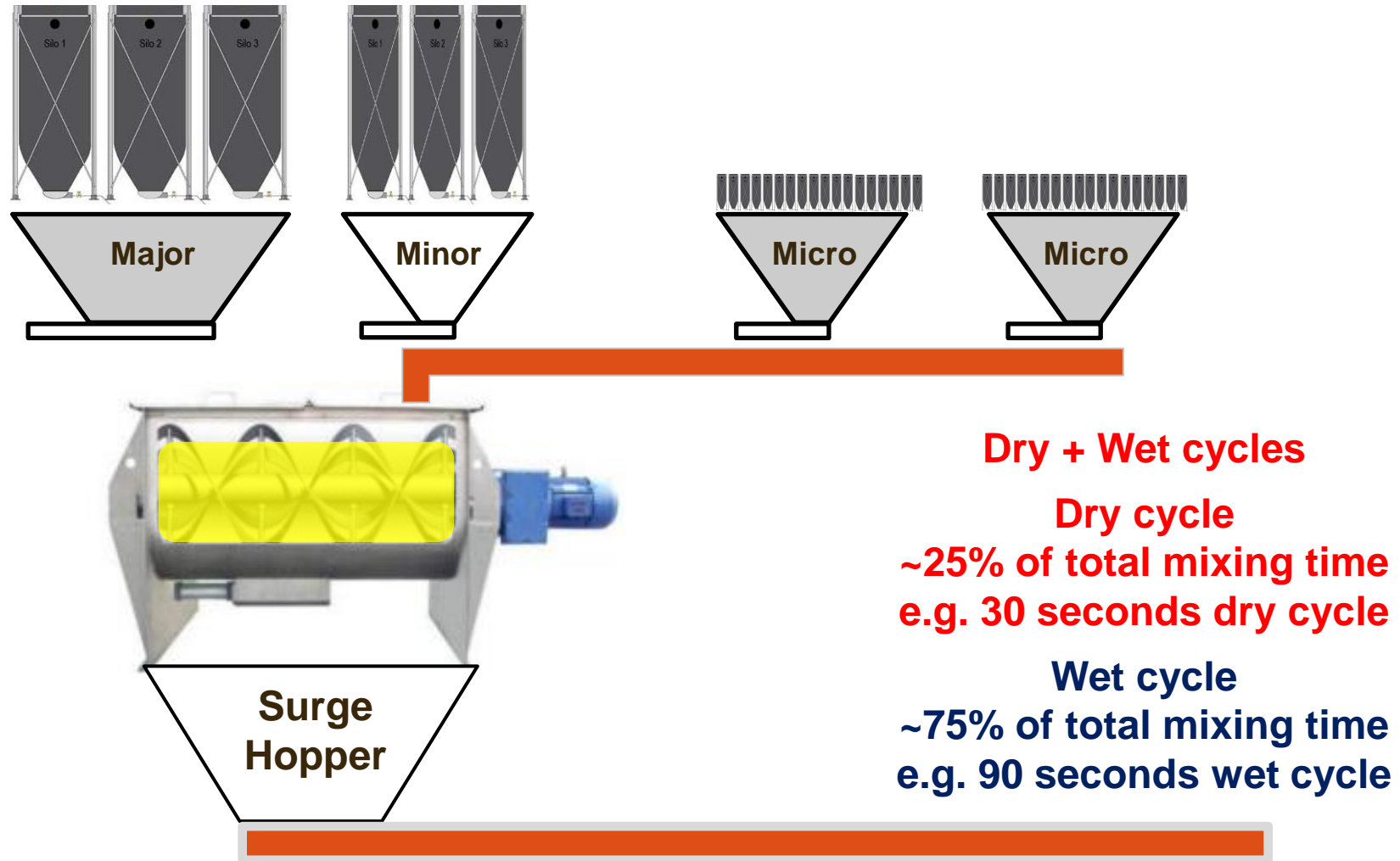
Mixing Sequence



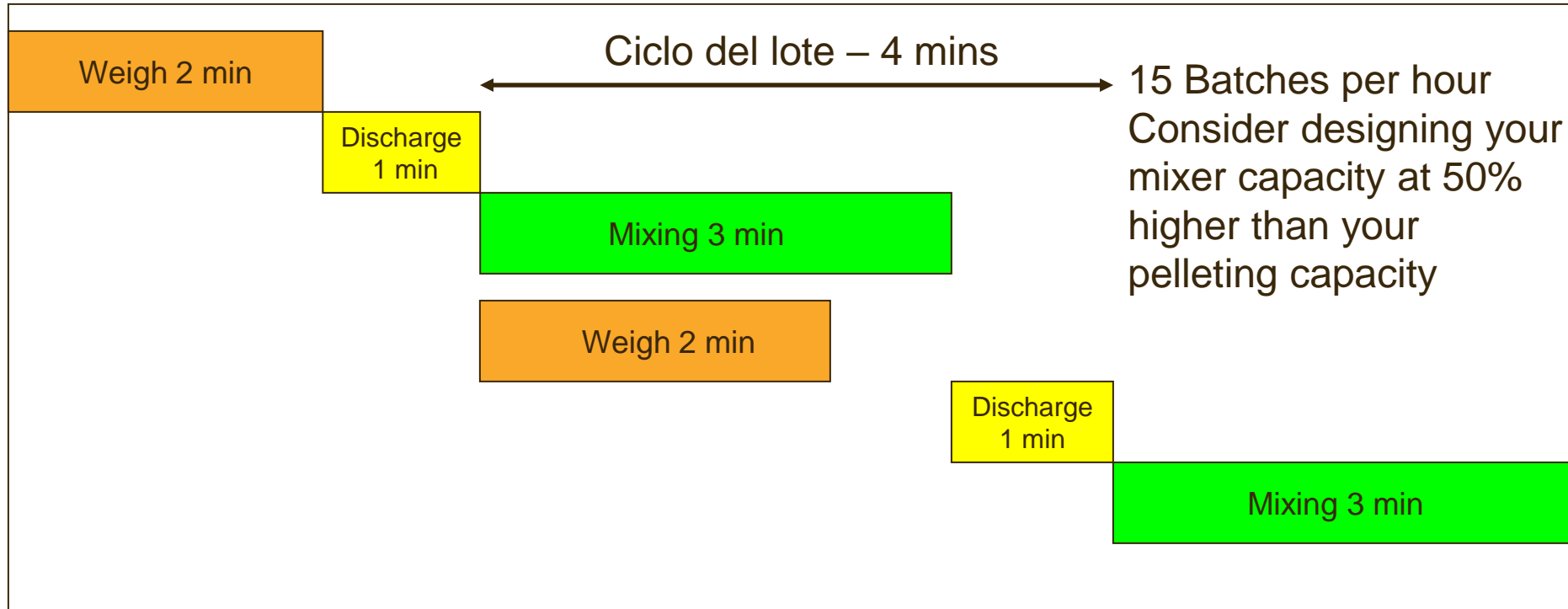
Liquids:

- Fat
- Amino acids
- Choline
- Water

Mixing Sequence



Total Batch Cycle





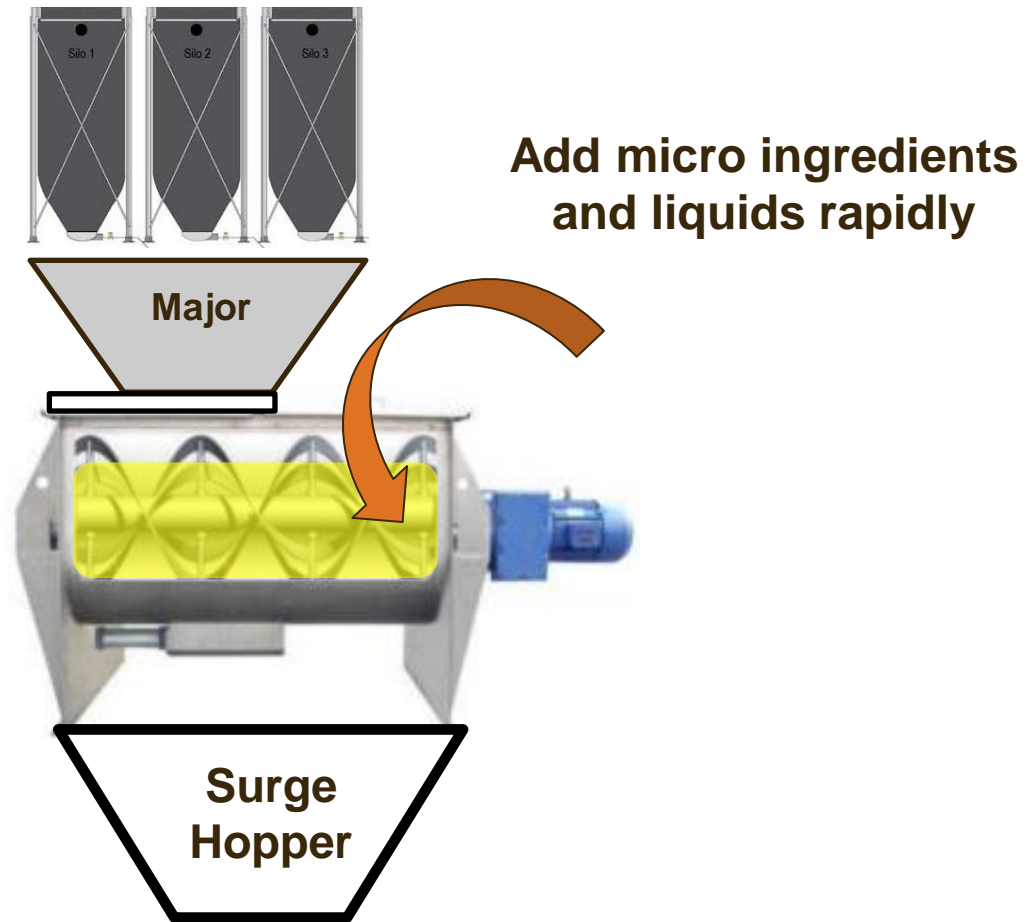
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Potential Problems

- **There are many potential problems that can occur during mixing:**
 - Overfilling the mixer due to changes in density
 - Spraying liquids on the ribbons (build-up)
 - Short dry and/or wet cycles
 - Incorrect order of ingredient addition
 - Broken ribbons
 - Scale accuracy problems

Potential Problems



Maintenance

- Inspect scale hoppers and mixer quarterly
- Check scales
- Check liquid meters 4 times a year
- Verify flushing procedures
- Perform a mixing analysis
 - Installation
 - Twice a year
 - After any preventive or corrective maintenance

Mixer Uniformity

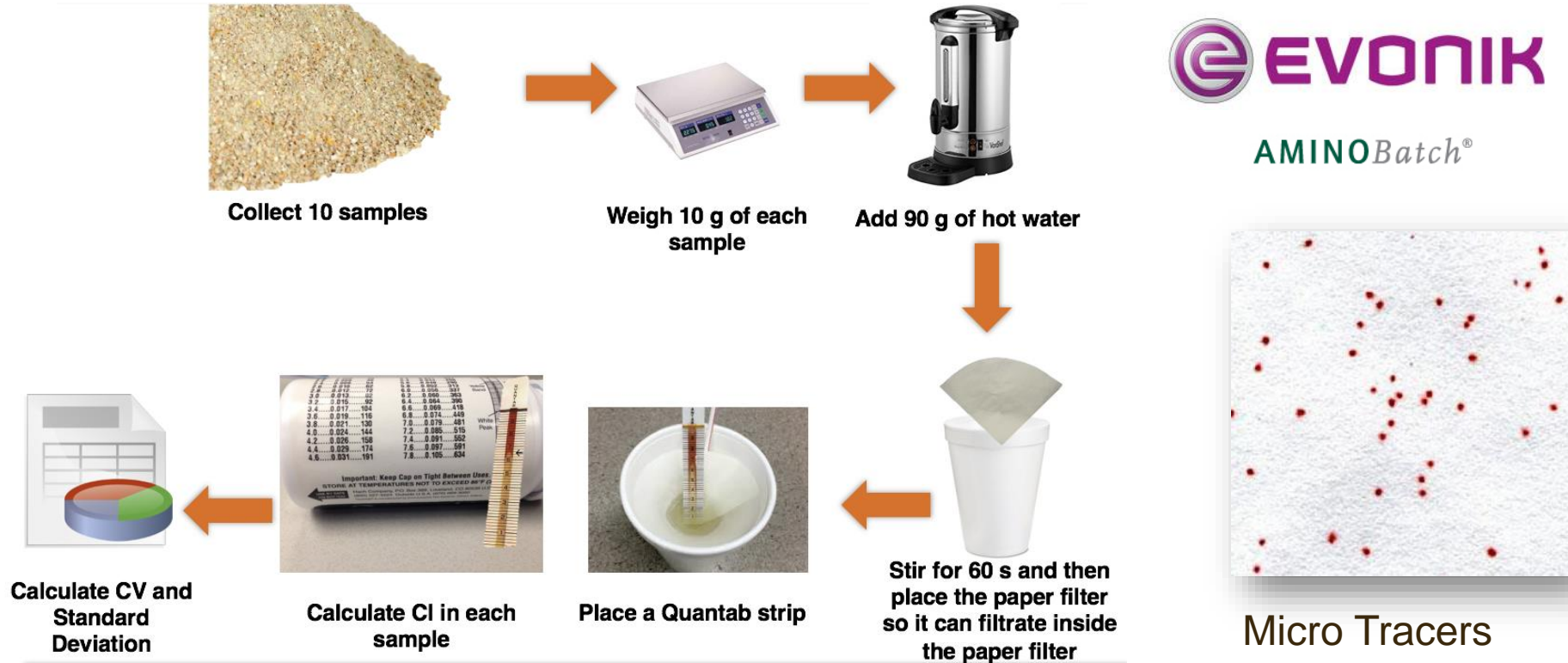
- Estimated by the coefficient of variation (CV) of a specific nutrient or ingredient (usually chlorine from salt)
- Used to measure the degree of dispersion of the ingredients in the batch of feed
- It is recommended a CV of 10% or less
- Generally mixing uniformity increases with increased mixing time



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Mixer Uniformity



Mixer Uniformity



Poultry Feed Quality Control

Mixer Uniformity

CV	Rating	Corrective Action
<10%	Excellent	None
10-15%	Good	Increase mixing time by 25% to 30%
15-20%	Fair	Increase mixing time by 50% look for worn equipment overfilling or sequence of ingredient addition
>20%	Poor	Possible combination of all of the above. Consult feed equipment manufacturer

Take Home Message

- Although mixing is simple, there are many potential problems that can occur such as:
 - Overfilling the mixer due to ingredient density changes
 - Build-up on the ribbons or paddles,
 - Inadequate dry and/or wet mixing times,
 - Incorrect order of ingredient addition
 - Leaking gates
 - Broken ribbons or paddles among others.

Take Home Message

- Potential mixing problems can be identified and fixed with:
 - Regular preventive maintenance
 - Visual inspections
 - Mixer uniformity tests
 - Mixers should be tested to evaluate uniformity after installation and at least annually
 - Mixer uniformity is estimated by the coefficient of variation (CV) of a specific nutrient or ingredient such as:
 - Chloride from salt
 - Trace minerals
 - Micro tracers
 - Synthetic amino acids
 - NIR
 - A CV of 10% or less is recommended

Thanks



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