Mixing and Temperature Control
Common Mixers for Tortillas

- Spiral mixer
- Vertical mixer
- Horizontal mixer
Mixing of Doughs: Objectives

- Uniformly incorporate ingredients
- Hydrate all dry materials completely
- Develop the gluten for proper handling quality and gas retention
Undeveloped Gluten
Developed Gluten
Factors Which Affect Mixing Time:

Machinery

- Speed of mixer (RPM)
- Mixer design
- Dough size / mixer capacity
- Adequacy of refrigeration
Factors Which Affect Mixing Time:

**Ingredients**

- Flour (protein)
- Water absorption
- Amount of shortening
- Amount of soy protein
- Amount of reducing agents
- Amount of oxidizing agents
Why Is Temperature Control Important?

• Controls final product consistency
• Controls the rate of reaction in baking powders.
• Controls the consistency of the dough.
• Affects ingredients solubility.
Temperature Control

- TEMPERATURE CHANGES THAT OCCUR DURING THE MIXING OF A DOUGH CAN BE ATTRIBUTABLE TO TWO PRINCIPLE CAUSES:

1. HEAT GENERATED BY THE FRICTIONAL FORCES.

2. THE HEAT OF HYDRATION OF FLOUR.
Other Factors Affecting Temperature Control

• Temperature of ingredients.
• Size and type of mixing equipment.
• Batch size.
• Mixing procedures: time, speed, stages.
• Room temperature: summer, winter.
Ways to manage temperatures

• Ingredient temperatures.
• Chilled water/ice water
• Mix times
• Mixer refrigeration
• CO2 chilling systems
Friction Factor Calculation

Straight dough system formula:

\[
FF = (3 \times A.D.T.) - (RT + FT + WT)
\]

ADT (Actual dough temperature)

FF (Friction factor)

FT (Flour temp.)

RT (Room temp.)

WT (Water temp.)
Calculation of water temperature to give desired dough temperature

**Straight Dough System**

\[
\text{Cal H}_2\text{O Temp.} = (3 \times \text{D.D.T.}) - (\text{RT} + \text{FT} + \text{FF})
\]

DDT (Desired dough temperature)
Calculation of Amount of Ice Needed to Give Desired Dough Temperature In Degrees Fahrenheit

Wt. of ice =

Wt. of $H_2O$ (Tap $H_2O$ Temp. - Cal. $H_2O$ Temp.)

Tap $H_2O$ Temp. + 112