Sticking and mold control

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Sticking – Package

- Sticking Defined:
  - Two or more tortillas that will not separate from each other without tearing or ripping after being packaged for any period of time.
- Sticking can be caused by several factors
  - Process
  - Ingredients
  - Formulation.

Sticking - Process Related Causes

- Mixing – over mixed
  - Rare to see tortilla doughs over mixed
    - Physically / mechanically ruptures protein
    - Gluten releases water
    - Hot dough temperatures
- Under mixed
  - Under-hydrated
  - Poor gluten hydration / development
  - Less absorption

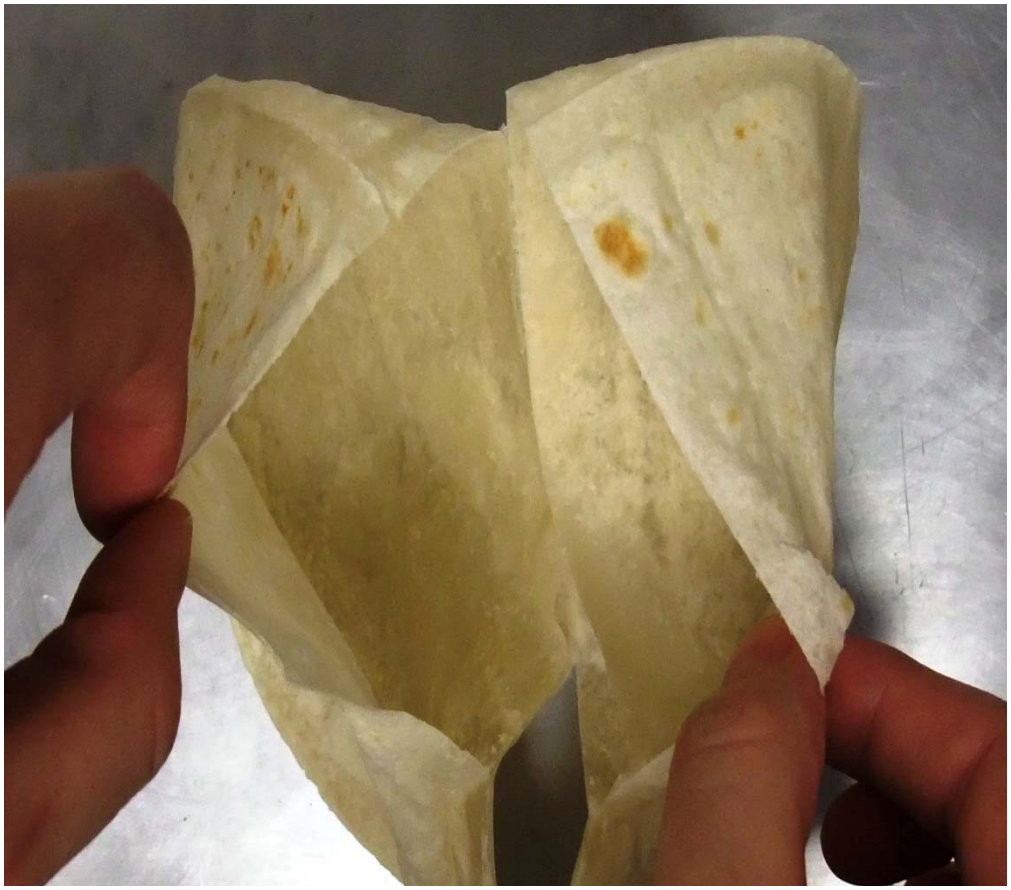
Sticking - Press Setup

- Dry, stiff doughs require increased pressure, dwell time and temperature to obtain correct sizes
  - ✗ gelatinizes (cooks) starch, sets structure
  - ✗ activates all leavening
  - – creates top and bottom crust which entrains steam increasing the likelihood of pillowing (puffing)
- Ideal press settings
  - ✓ dwell time = ~1.3 seconds +/-0.2
  - ✓ pressure = ~ 1000 psi +/- 200
  - ✓ temperature = ~375 / 400 +/- 25°F
  - ✓ New Mega Presses = < 325°F

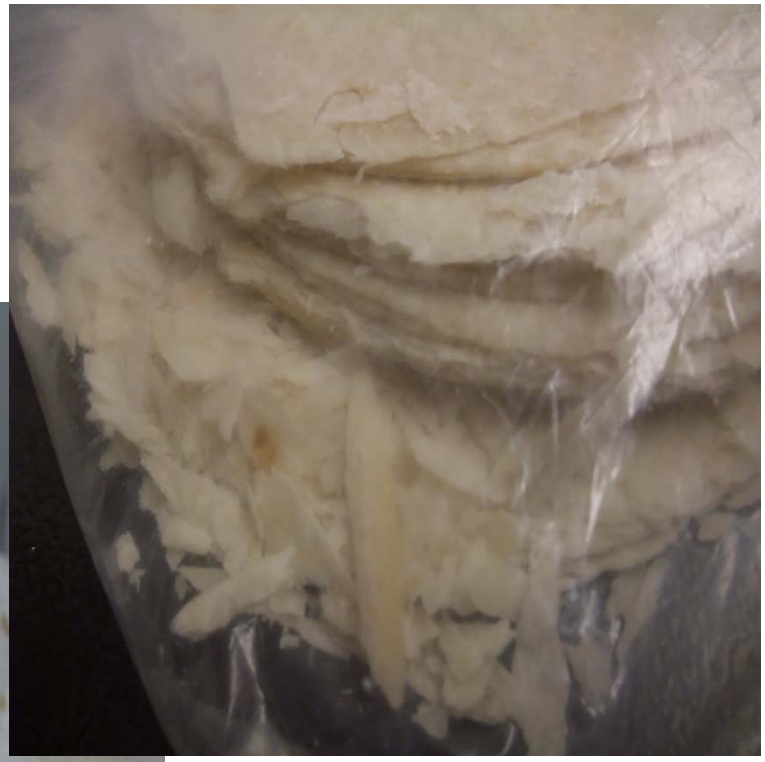
Sticking - Baking Profile

- Under baking
  - Excess residual moisture
  - Insufficient surface drying
- Over baking - creates pillowing or puffing
  - top -thin crust separates from thick -bottom crust
  - thin crust and blisters are weak
    - tear and flake

Over baking



Over
baking +
Zippering



Sticking
Cooling room

- Purpose of the cool down is to fully prepare the tortilla for packaging, transportation and storage
- Typical cooler conditions
  - cool and HUMID, 35 - 40°F @80%+RH
    - Room is cool and wet causing mist / dew / fog to condense back on the tortilla
- Cooler conditions must be adjusted to obtain:
  - Tortilla pack temperature +/- 10°F package room
  - Humidity **<** 60%RH – critical

Sticking - Packaging

- Minimize temperature shifts after packaging
  - promotes moisture migration
    - 80°F packing into case
    - 50 -100°F warehouse temperature
    - 20 - 140°F truck shipping temperature winter / summer
    - 70°F grocery store temperature
    - 40°F consumer refrigeration
- Avoid excessive compression
  - over-packing
  - excessive weight

Sticking -Ingredient causes

- Flour - weak flour
  - poor gluten quality, although quantity may be available
  - translates to:
  - poor dough process tolerance
  - weak baked film formation
  - poor resistance to compression

- Strong Flour
  - enhances pillowing - better gas retention

Sticking - Reducing Agents

- L-Cysteine and Sodium Metbisulfite
  - greater extensibility in the dough
  - higher levels (>60ppm) lead to weak protein and crust resilience.
  - Increases the occurrence of sticking

- Obtain dough consistency through full mix development

Sticking –Fat effect

Type of fat being used is critical:

- Liquid oils remain liquid at room temperature
  - Increases surface adhesion on the tortilla
  - Liquid oils will always create zippering
  - Use <30% of normal levels if using oil

- Use higher melt point fa
  - higher solids at room temperature

Sticking -Water

- Case Study
  - Tortilla plant ran water trials from 55% - 38%
    - Still had sticking at 38%
      - Its not the quantity of water that's the problem
  - Water is both a strengthener and a tenderizer
    - Hydrates protein
    - Hydrates Gums
    - Higher viscosity gums may continue to hydrate for 48 hours if insufficiently hydrated during mixing
  - Temperature is critical to rate of hydration
    - Cooler = cold, sticky, bucky dough
    - Warmer = Sticky, extensible doughs

Sugar and sticking

- Sugar is a tenderizer
- Sugar is hygroscopic
- As sugar increases, hygroscopicity increases
  - increases stickiness and tenderness.
  - Dextrose, glucose, fructose and lactose are hygroscopic

Microbial stability

- SOURCES
- SOLUTIONS

Sources of mold contamination

- Ingredients, specifically - FLOUR, GRAINS
- Air:
  - Atmospheric - plants require positive air flow – fscreened through HEPA Filter
  - Compressed air – must be monitored
- Environmental testing, especially doorways, trash areas, packaging area and cooling room, points of air ingress.
- Test equipment specifically cooling and packaging
- People - hands

Conditions for mold growth

- Temperature: mold grows best at 80 F (27C) degrees and 80 percent relative humidity
- pH: mold likes slightly acid conditions (6-7)
- Respiration: oxygen, carbon, hydrogen, nitrogen
- Moisture: higher water activity promotes mold growth (.87 to 1.0)
- Time: Mold can appear in 2 to 5 days

Mold Inhibitors

- Potassium sorbate: Potassium salt of Sorbic Acid
  - Inhibits yeast, mold and some bacteria.
  - Used in chemically leavened products 0.2 - 0.5 % flour basis
- Sorbic acid:
  - Added benefit of reducing pH
  - Low solubility water < $120^{O}F$
- Natural – cultured, fermentation producing organic acids

Mold inhibitors - Artificial

- Calcium propionate: Calcium salt of propionic acid
- Inhibits mold, bacteria BUT NOT YEAST
  - Free flowing powder or crystal
  - Used at 0.2 - 0.5 % flour basis.
  - Functional pH < 5.5

Mold Inhibitors

- Sodium propionate: Sodium salt of propionic acid
  - Used more in chemically leavened products, since calcium may delay the reaction of baking powders
  - Hygroscopic
  - Functional pH < 5.5

Acidulants used in tortillas

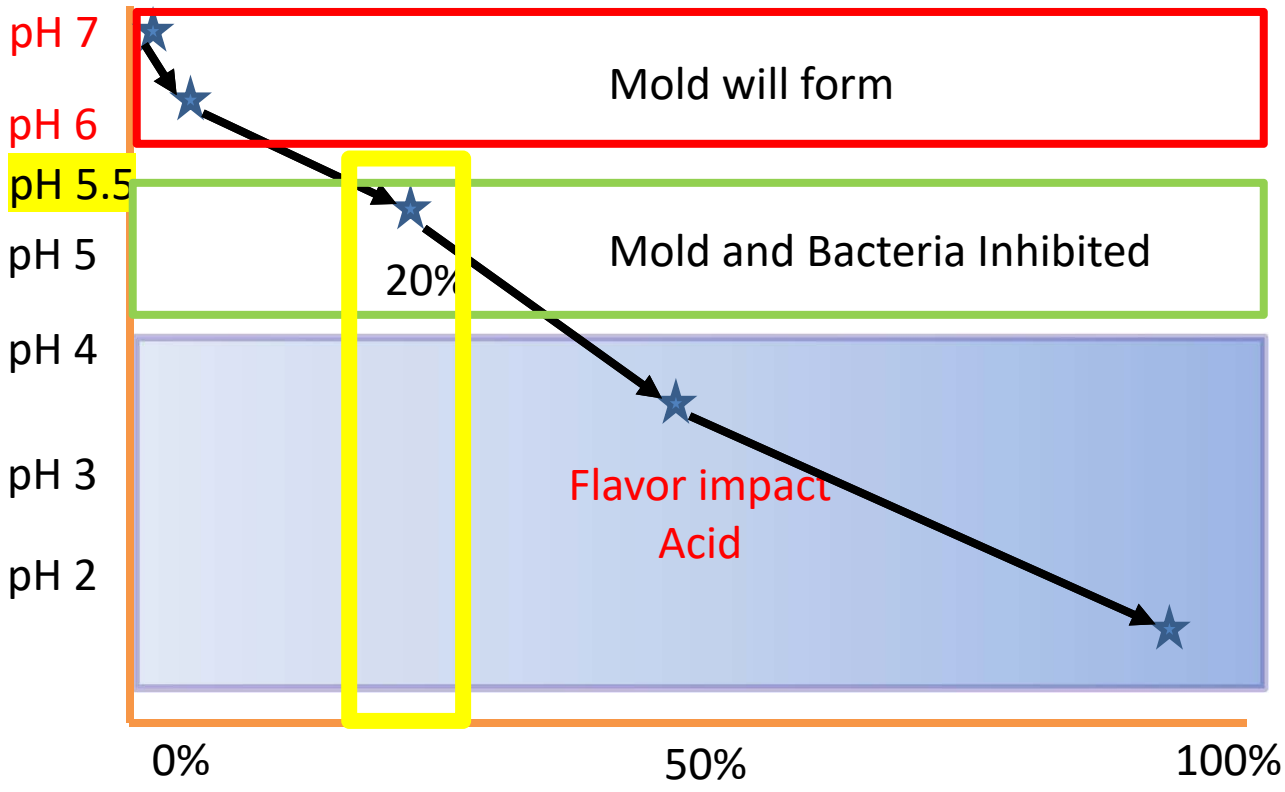
- Best solution:
- Fumaric acid
  - Hot water soluble – inhibits pre-reaction with baking powder

- Other solutions
- Malic, Citric, Adipic, Tartaric, Acetic (vinegar), Phosphoric
  - All will affect flavor and texture
- Encapsulation will help retard the baking powder pre-reaction.

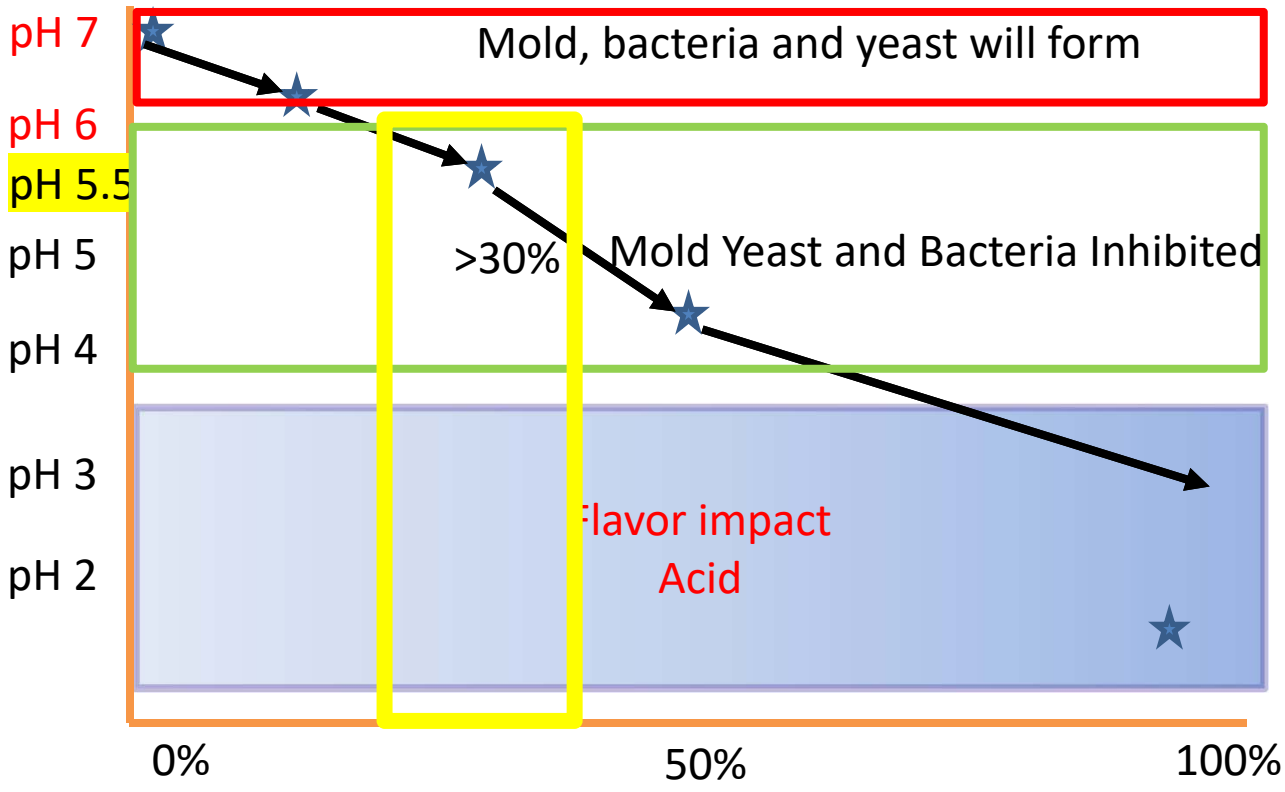
Microbial Stability

- Balance between:
  - Shelf life expectations
  - pH
  - Preservatives
  - Homogenized ingredients

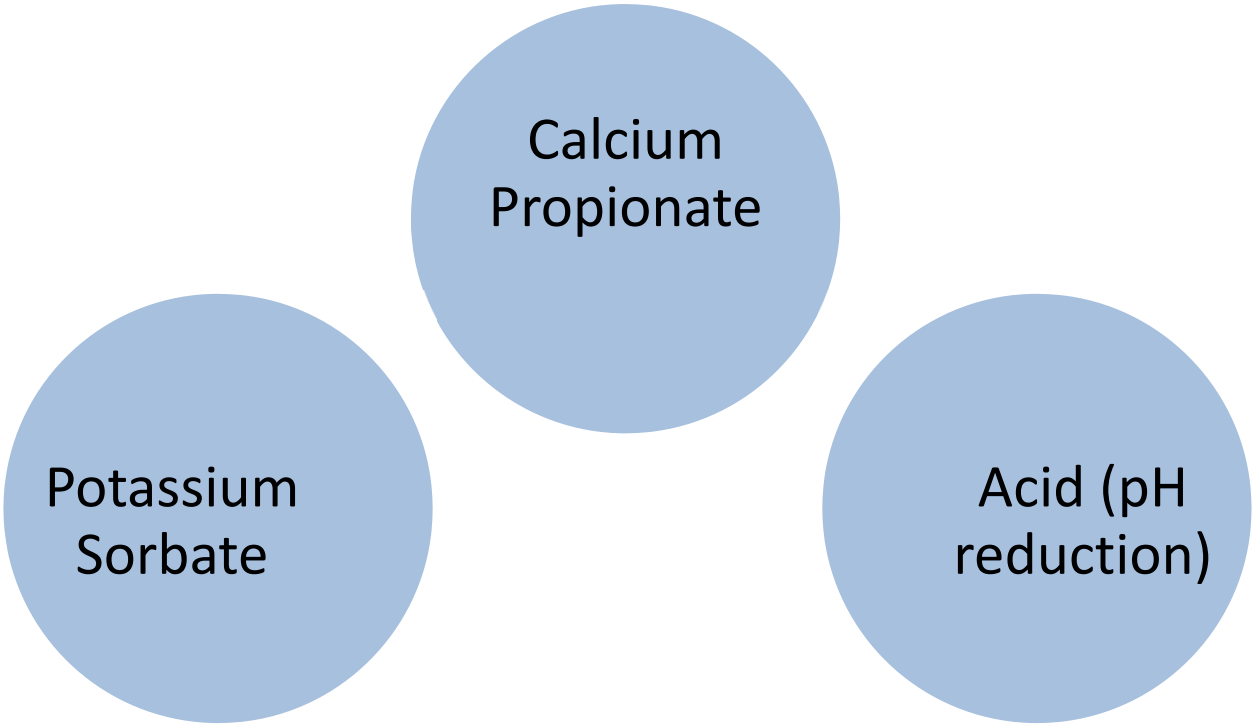
Effectiveness of calcium propionate at different pH levels



Effectiveness of sorbic acid different pH levels



Preventing mold – ingredients
Three legged stool



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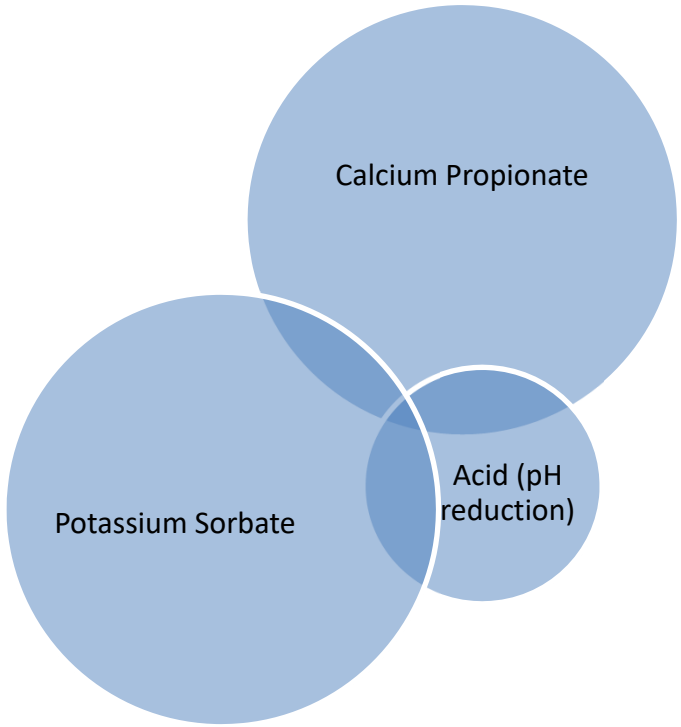

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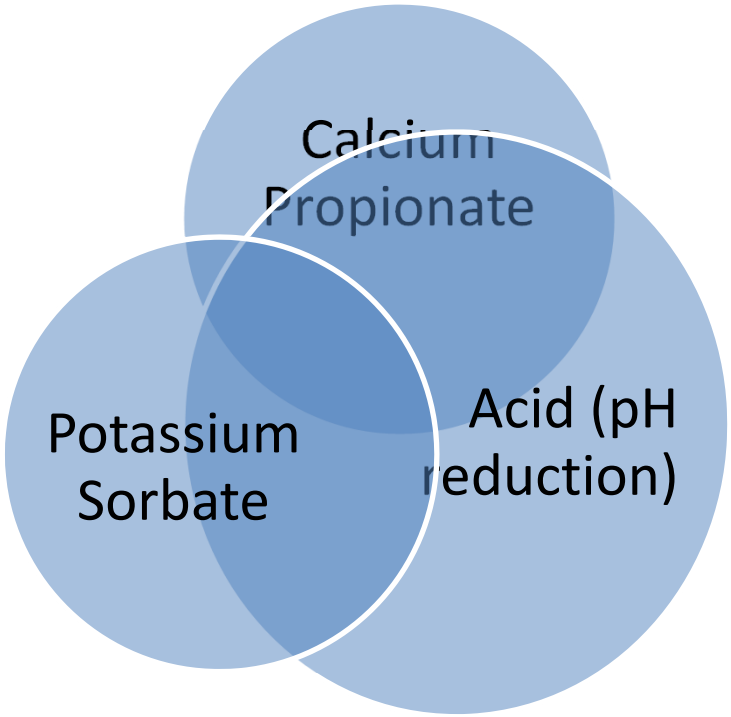

Control of mold

- Minimize contamination of product with mold
- Control factors that enhance mold growth
- Establish clear expected shelf life
- Usage of mold inhibitors – balance preservation system
  - Natural
  - Artificial
- Optimize acids and pH