Flour Tortilla Extensibility and Translucency and Mono and Diglyceride Replacement

TIA 2018

Presenter: John Hinds, Cain Food Industries
What's corny.

Actually, it's flour.
Flour Tortillas

- Flour
- Water
- Fat
- Salt
- Leavening
- Its “Simple” right?
Tortilla Quality Problems

- Misshaped
- Lacy Edges
- Dog Ears
- Translucency
- Thin
- Sticking
- Zippering/ Flaking
- Brittle/ Bursting/ Lack of Rollability
- Dry texture and cracking
- Mold
SIMPLE

INGREDIENTS: Enriched Bleached Wheat Flour (Wheat Flour, Malted Barley Flour, Reduced Iron, Thiamin Mononitrate, Riboflavin, Folic Acid), Water, Vegetable Shortening (Contains one or more of the following: Palm oil and/or Corn oil), Contains 2% or less of the following: Salt, Aluminum Free Leavening (Sodium Acid Pyrophosphate, Sodium Bicarbonate), Corn Starch, Monocalcium Phosphate, Calcium Propionate, Monoglycerides, Enzymes, Cellulose Gum, Guar Gum, Fumaric Acid, and Calcium Propionate and Sorbic Acid (to preserve freshness). Contains: Wheat.

Contains: Wheat

Nutrition Facts
Serving Size 1 Tortilla (59g)
Servings Per Container 8

Amount Per Serving
Calories 120
Calories from Fat 80

% Daily Value
Total Fat 14g 22%
Saturated Fat 5g 25%
Trans Fat 0g
Cholesterol 0mg 0%
Sodium 770mg 33%
Total Carbohydrate 20g 7%
Dietary Fiber less than 1g 0%
 Sugars less than 1g
Protein 1g

Not a significant source of vitamin A or vitamin C.

Contains: Wheat

INGREDIENTS: Enriched unbleached flour (Wheat flour, Malted Barley flour, Reduced Iron, Thiamin Mononitrate, Riboflavin, Folic Acid), Water, Vegetable shortening (Contains one or more of the following: Palm oil and/or Corn oil), Contains 2% or less of the following: Salt, Aluminum Free Leavening (Sodium Acid Pyrophosphate, Sodium Bicarbonate), Corn Starch, Monocalcium Phosphate, Wheat protein, Preservatives (Calcium Propionate, Sorbic acid), Dough conditioner (Fumaric acid, Gum Guar, Lecithin, Mono and Di-Glycerides, Sodium Metabisulphite), Allergens: Wheat and Soy.

INGREDIENTES: Harina de trigo enriquecida y sin blanquear (trama de trigo, Nasafla, Hierro reducido, Mononitrato de Timina, Riboflavina y Ácido fólico). Agua, Grasa vegetal (Contiene uno o mas de los siguientes: Aceite de palma y /o Avena de maíz), Contiene 2% o menos de los siguientes: Sal, Leudante sin aluminio (Pirofósforo ácido de sodio, Bicarbonato de sodio, Amonio de maíz, Fosfato monocalcico), Preservantes (Propionato de calcio, Ácido sorbico), Ascorbónico de trigo (Ácido fumarico, Mezcla de gomas, Lecitina, Mono y diacetilénidos, Metabisulfito de sodio), Allergenos: Trigo y Soja.

CONTAINS WHEAT, SOY

MADE IN A BAKERY THAT MAY ALSO USE SOY.
Functional Ingredients

Effect
- Mix Reducers
- Strengtheners
- Shelf Life Extenders/Softeners
- Emulsifiers
  - Mono-Diglycerides
- Others: Leavening etc.

Source
- Chemicals and Synthetics
- Acids
- Gums/Hydrocolloids
- Enzymes
- Proteins
- Fats
- Starches
- Herbs and Spices
Mix Reducers / Dough Relaxers:

Function: Reduce mix time and energy requirements by interrupting or cutting the gluten network.

Types:
- L-Cysteine, Sulfites, Sorbic Acid, Fumaric Acid
- Inactive Yeast and Glutathione
- Garlic
- Enzymes
  - Protease, Papain, Bromelain, Xylanase
- Protein Isolates
Mix Reducers / Dough Relaxers:
Mixing Development with Mix Reducers

Blank Dough

L-Cysteine Dough
Mix Reducers / Dough Relaxers:

**Product Improvements:**
- Improve dough extensibility
- Reduce dough temperature
- Reduce resistance to pressing and reduce “lacy” edges.
- Reduce shrink back and curling of edges.
- Improve finished product shape
- Can reduce translucency when optimized

**Other:**
- Can create sticky, wet dough
- Can tenderize the finished tortilla
- Can cause more color
Strengtheners/ Oxidizers

Function: Increase gluten formation and dough strength by improving gluten bonds.

Types
- Vital Wheat Gluten
- DATEM and Ethoxylated Mono-glycerides
- Ascorbic Acid
- Enzymes
  - Glucose Oxidase, Phospholipase, Xylanase, Transglutaminase
- Protein Isolates
- Soy Flour
Strengtheners

Product Improvements:
- Increase dough elasticity
- Increase dough cohesiveness
- Improve webbing strength in die cut processes
- Reduce vital wheat gluten and improve flour quality
- Increase product toughness and decrease bursting
- Can reduce cracking and flaking when flour quality is poor

Other:
- Can increase shrink back and resistance to pressing.
- Can increase translucency
- Increase chewiness and toughen the product.
Shelf Life Extenders / Softeners

Function: Improve or extend product freshness.

Type
- Fat
- Sugar
- Emulsifiers
- Starches
- Enzymes
  - Amylase, Lipase, Xylanase
- Gums and Hydrocolloids
Extensibility/Toughness Analysis by Texture Analyzer

Blank Restaurant Style Tortilla vs. Guar Gum
Shelf Life Extenders / Softeners

**Product Improvements:**
- Improve rollability
- Reduce bursting
- Improve softness of bite
- Improve moisture retention
- Improve overall product texture

**Other:**
- Can tenderize the product
- Can create more color/toast points
Emulsifiers

Function: Stabilize Oil in Water or Water in Oil Suspension.

Type

- Mono and di-glycerides, SSL, CSL, DATEM,
- Lecithin
- Some Gums and Hydrocolloids
- Enzymes
  - Lipase, Phospholipase
- Protein Isolates
### Common Emulsifiers in Baking

<table>
<thead>
<tr>
<th>Food Surfactants/Emulsifiers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lecithins</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Polyoxyethylene sorbitan esters</strong> (Polyoxylethylene Sorbitan Esters)</td>
<td></td>
</tr>
<tr>
<td><strong>Mono- and diglycerides of fatty acids (MDG)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Acetic acid esters of MDG (ACETEM)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Lactic acid esters of MDG (LACTEM)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Citric acid esters of MDG (CITREM)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Mono- and diacetyl tartric acid esters of MDG (DATEM)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sucrose esters of fatty acids (Sucrose esters)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Polyglycerol esters of fatty acids (Polyglycerol esters)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Polyglycerol propylene carbonate (PGPR)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Propylene-1,2-diol esters of fatty acids (Propylene glycol esters)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sodium stearoyl-2-lactylate (SSL)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Calcium stearoyl-2-lactylate (CSL)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sorbitan fatty acid esters (Span)</strong></td>
<td></td>
</tr>
</tbody>
</table>

Emulsifiers

**Product Improvements:**
- Reduce dough tackiness
- Improve dough stability and strength
- Improve finished product texture
- Improve moisture retention and reduce staling rate.
- Reduce finished product sticking
- Can reduce translucency when optimized

**Other:**
- Increase tenderness in finished product
- Can create waxy mouthfeel
Monoglycerides, Diglycerides and Triglycerides

- Triglycerides are naturally present in fats and oils.
- Triglycerides are naturally present in flour.

http://biology.unm.edu/ccouncil/biology_124/summaries/Macromol.html
Emulsification: Surface Tension Reduction

- Polar, Hydrophilic, Water Loving (Glycerol) Head
- Non-Polar, Lipophilic, Fat Loving (Fatty Acid) Tail
- Allows Water and Oil/Fat to mix and stabilize together.
  - Reduces sticking: dough and tortilla (stacking)
  - Retains moisture: softening
  - Improves machinability
  - Improves texture
  - Increases leavening: Gas Retention

[Image: Diagram of surfactant stabilizing oil droplet]
Softening: Starch – Lipid Complexing

- The starch-lipid complexing improves softening by reducing the ability of amylose to retrograde over time.
- This is similar to the mechanism by which Mono-diglycerides and SSL function.
Reducing Sticking

Adhesion
- Two **different** substances “sticking” together chemically usually through hydrogen bonding
- Water sticking to dough

Cohesion
- Two **like** substances sticking together through hydrogen bonding.
- Water sticking to water

https://www.adhesiveandglue.com/adhesion-definition.html
Emulsifiers – Mono and diglycerides

Function

- Reduce dough tackiness
- Reduce Translucency
- Increase tenderness in finished product
- Improve finished product texture
- Improve moisture retention and reduce staling rate.
- Reduce finished product sticking
Replacement Options

- Enzymes
- Hydrocolloids/ Gums/ Proteins
- Fats
- Lecithin
- Processing
Enzymes- Lipase

Lipase is an enzyme that catalyzes the hydrolysis of lipids, which are fats and oils derived from triglycerides. The reaction is shown in two steps:

**a. Synthesis**
- **Substrates**: Triglyceride
- **Product**: Diglyceride

**b. Degradation**
- **Substrate**: Diglyceride
- **Product**: Monoglyceride

The reaction is catalyzed by lipase, which binds to the substrate (or product) at a specific site called the active site. The structure of proteins can be found at [http://encyclopedia.lubopitko-bg.com/Structure_of_Proteins.html](http://encyclopedia.lubopitko-bg.com/Structure_of_Proteins.html)
Hydrocolloids/ Gums

- Gum Arabic (Acacia Gum), Guar Gum, Cellulose Gum etc.
  Highly Hydrophilic
- Bind water, can reduce free water
- Can form films around oil droplets or increase viscosity to reduce oil and water coalescence or separation
Fats and Oils

- Butter
- Tallow
- Lard
- Palm Oil
- Soybean/ Vegetable Oil and Shortening

**Key Attributes:**
- Plastic or Liquid
  - Melt Point/Drop Point
  - Saturation
Lecithin

- Lecithin: natural emulsifier
  - Egg and soy, sunflower or canola
  - Available for Organic
- Unique properties can be adjusted to be more hydrophilic or hydrophobic
- Will stabilize oil in water emulsion and can help reduce adhesion
- Can complex with gluten to improve strength, rollability and stretch
- Improves moisture retention through shelf life
Process and Packaging

- When eliminating mono and diglycerides you may also need to adjust your processing parameters to reduce finished product sticking in the package.

- Factors that effect sticking:
  - Press Pressure and Temperature
    - Stiff, elastic dough needs more heat and pressure to meet size requirements
    - This causes gelatinization and fires leavening
    - Tortillas will puff and create weak points
  - Under Baking
    - Increased moisture levels
  - Over Baking
    - Pillowing
  - Insufficient cooling time or temperature
    - Finished Product should be +/- 10°F of the packaging room
    - Low relative humidity
  - Excessive stacking or compression
Other Functional Ingredients

- Leavening
- Sugar (Sucrose) and Dextrose
- Starch, Modified Starch
- Alternative Flours
- Fiber and Nutrients
- Organic/Non-GMO/Natural
THANK YOU!

QUESTIONS?