Four Shortening Test Study in Tortillas Lecithin in Tortilla Frying Options for Chips

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Technical Service
Bunge

Nutrition Facts

6 servings per container

Serving size: 1 tortilla (42g)

Amount per serving

Calories 110

	% Daily value*
Total Fat 3g	**3%**
Saturated fat .3g	**1%**
Trans Fat 0g	
Cholesterol	**0%**
Sodium 177 mg	**7%**
Total Carbohydrate 18g	**6%**
Dietary Fiber 2g	**8%**
Total Sugars 0g	
Includes 0g added sugar	**0%**
Protein 3g	**6%**
Vitamin D 0 mcg	0%
Calcium 38 mg	4%
Iron 0 mg	0%
Potassium 146 mg	3%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2000 calories a day is used for general nutrition advice.

Labeling Requirements for Shortening in Tortillas

- **Often dictated by marketing requirements**
  - **Desire to make specific label claims (Low in Saturated fats, etc)**
  - **Desire for "clean" ingredient declaration (no antioxidants or artificial ingredients)**
  - **Desire for "green" or "Sustainable" ingredients**

Functional Requirements for Shortening in Tortilla Doughs

- Functional Requirements for Processing:
  - Smooth, plastic texture
    - Must have good SFC content and moderate Melt Point
    - Too much liquid oil makes a sticky dough and leads to excessive translucency in the finished product.
  - Good mixing characteristics
    - Must cream in with dry ingredients to smear onto flour and coat ingredients properly
    - Must not leave lumps of shortening in the dough
      - Can cause holes in the finished tortilla

Functional Requirements for Shortening in Tortillas

- Good Flavor and Stability
  - Resistant to oxidation
  - Good Flavor profile
    - Clean and complimentary to the baked product
    - Good mouthfeel (not waxy or oily)
  - Tolerant of temperature
    - For instance, if you have refrigerated or frozen distribution for finished products.

Dough Applications

- Tortilla Dough Fat Options
  - Lard and Tallow $$$ (cost / limited availability)
  - Palm and Palm Fractions $$ (Low cost /reliable supply)
    - Available with emulsifier for automated processing lines
  - Interesterified Soy All Purpose $$ (low cost /domestic supply)
    - Available with emulslifier for automated processing lines

Strategies for Shortenings

- A certain level of Saturates is required
  - Give proper texture to the dough
  - Mouthfeel- eating quality
  - Dough processing

- Saturates can come from:
  - Natural Saturates (Palm, Palm Fractions, PKO)
  - Fully Hydrogenated Saturates (Interesterified)
    - Full Hydro Soy or Cottonseed

Sustainability at Our Core

Sustainability is core to our business. We make decisions across our value chain built on a foundation of ethical leadership, accountability and environmental stewardship.

We want to be a leader in our industry, urging sustainability and responsibility at every step along the supply chain from the farm to the table.

Action on Climate

We implement innovative solutions to minimize our environmental footprint and support projects and activities that strengthen our approach to fighting climate change.

Responsible Supply Chains

We promote sustainable agriculture and implement robust projects that protect and improve the environment, while supporting the social and economic well-being of growers and local communities.

Accountability

We aim to be an accountable leader within in our industry, helping to raise the bar on our sector's performance by regularly tracking and disclosing progress on our commitments and sustainability performance.

Sustainability at Our Core

Action on Climate

Reducing our GHG emissions and enhancing climate-focused activities

Science-based targets for our operations and our supply chains

Scope 1 & 2	Scope 3
25% by 2030	12% by 2030

Growing in low-carbon markets like renewable fuels and plant-based foods

Assessing climate risks and opportunities

Responsible Supply Chains

Promoting sustainable agriculture, and supporting farmers and local communities

End deforestation in our supply chains in 2025

Respect human rights and indigenous community rights

Sustainably source our major commodities

Provide new opportunities for growers and farmers

Ensure respect for legally protected areas and compensation to farmers for environmental services

Accountability

Transparency and engagement with our customers, investors, suppliers and communities

Linking sustainability performance to $1.75b loan

Regularly disclosing progress on public commitments through annual reports and dashboards

Engaging with stakeholders in workshops and consultations

Strong ESG ratings and scores across major platforms

Leadership in key industry associations and networks

Shortening Requirements for High Speed Processing Lines

- **Typically contain a small dose of emulsifier**
  - Helps with dough processing
    - Makes doughs less sticky on rollers and belts
  - Improves packaged product stability
    - Extends shelflife by minimizing starch retrogradation and therefore keeps the dough soft
    - Prevents the individual tortillas in a stacked package from sticking together **(known as welding).**
    - Interesterified Soy products are more tolerant of freeze/thaw cycle

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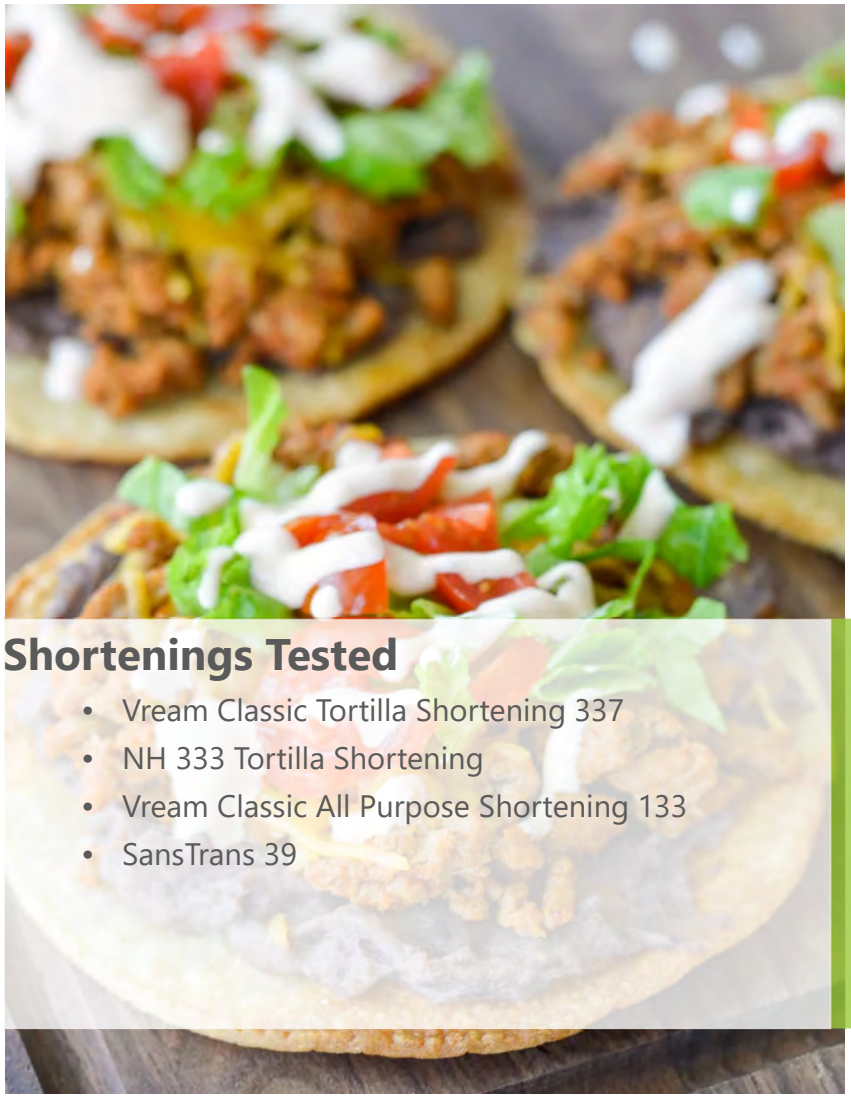
Tortilla Case Study

May 2024

Tortilla Formula

Ingredients	Bakers Percent(%)
Wheat flour	100.00
Water	60.00
Shortening	16.50
Salt	2.00
Baking powder	1.00
Calcium propionate	0.50
Potassium sorbate	0.40



Shortenings Tested

- Vream Classic Tortilla Shortening 337
- NH 333 Tortilla Shortening
- Vream Classic All Purpose Shortening 133
- SansTrans 39

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Tortilla Manufacturing Pilot Plant

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Four Shortening Characteristics

		SFC @ 10C	SFC @ 30 C	SFC @ 40 C	Melt PT F	Mono
Vreamay 337	EIE Soy Mono	28	15	7	115	Yes
NH 333	Palm Mono	49	12	3	101	Yes
Vream 133	EIE Soy	37	19	8	122	No
SansTrans 39	Palm	52	9	3	104	No

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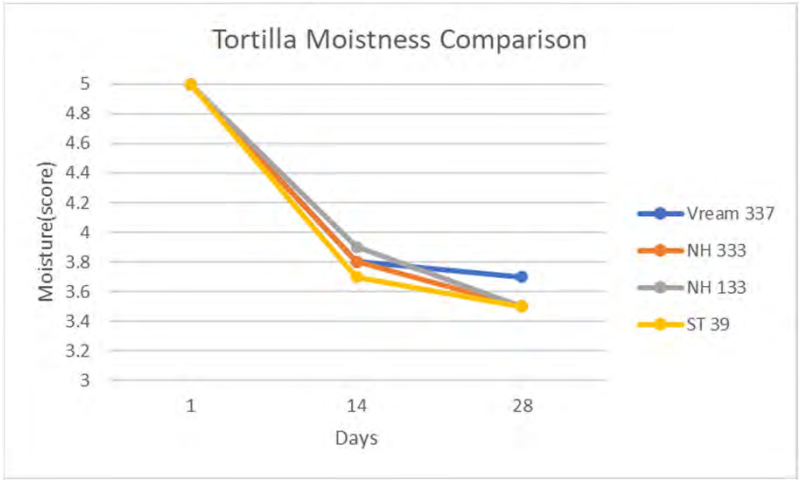
Tortilla Moistness

- During the first 14 days of shelf-life, there is steep moisture drop
- Moisture decline gradually slows down between 14 and 28 days
- Bunge emulsified tortilla shortening (Vream 337) can improve tortilla's moisture holding capability



Starch retrogradation happens during tortilla shelf life, the emulsifiers in Bunge Vream 337 tortilla shortening can help reduce staling and increase pliability for tortillas. These emulsifiers also bind water and oil, which can help increase tortilla moisture holding capacity

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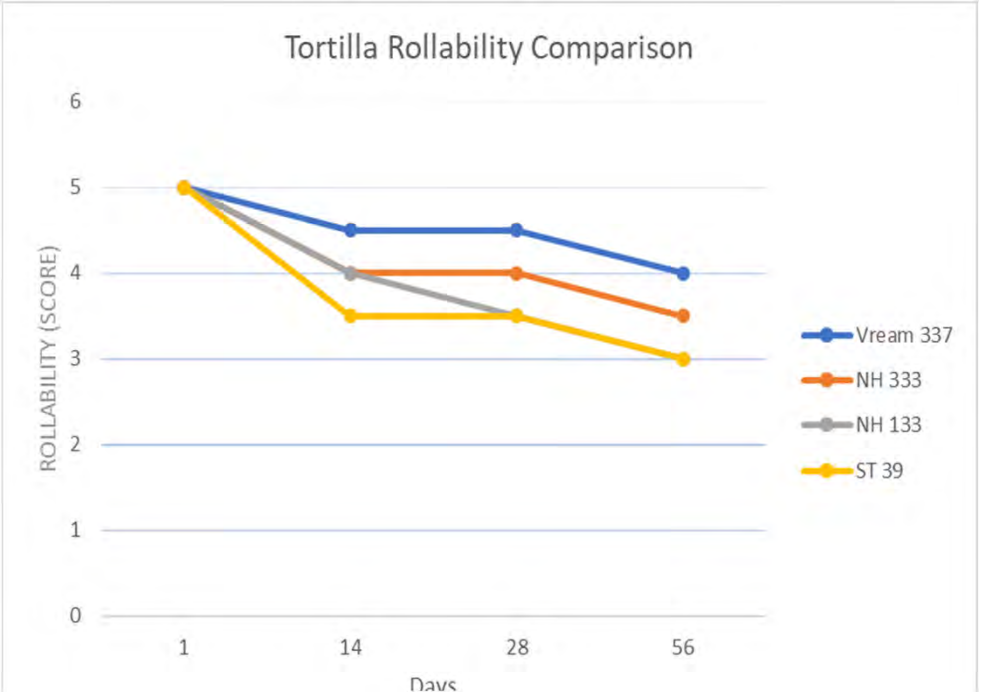
Rollability

- Right after production, all samples showed excellent rollability; rollability declined over time on the shelf: there was a significant drop within the first 14 days, followed by a slower decline, and another substantial decrease after 28th day.
- Compared with all-purpose shortening, Bunge's emulsified tortilla shortening (Vream 337 and NH 333) shows better performance in improving tortilla rollability over shelf life



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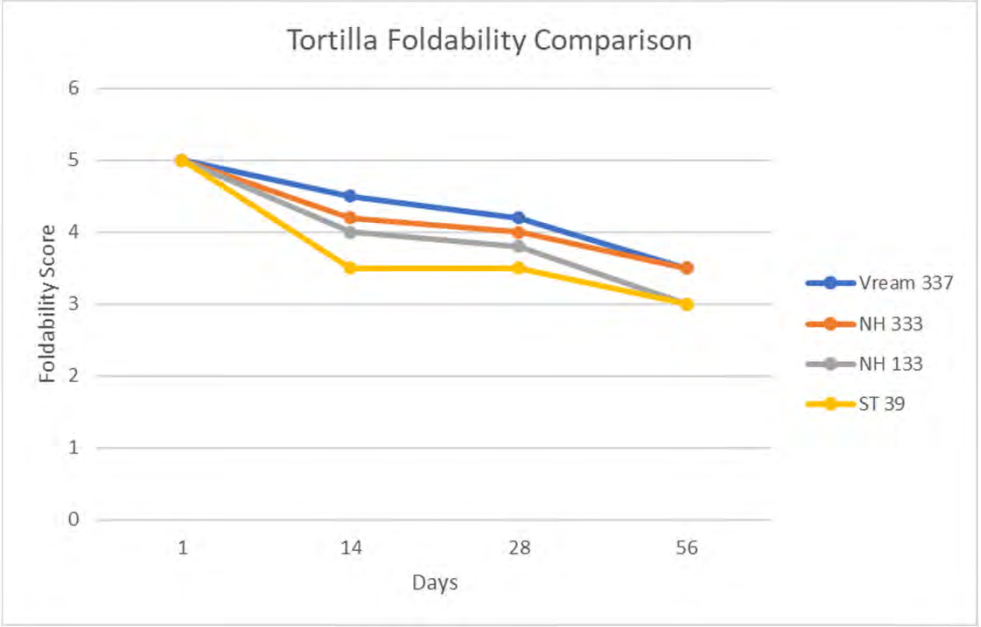
Foldability

- Right after production, all samples showed excellent foldability; similar to the rollability, foldability declined over time on the shelf: there was a significant drop within the first 14 days, followed by a slower decline, and another substantial decrease after 28th day.
- Compared with all-purpose shortening, Bunge's emulsified tortilla shortening (Vream 337 and NH 333) shows better performance in improving tortilla foldability over shelf life



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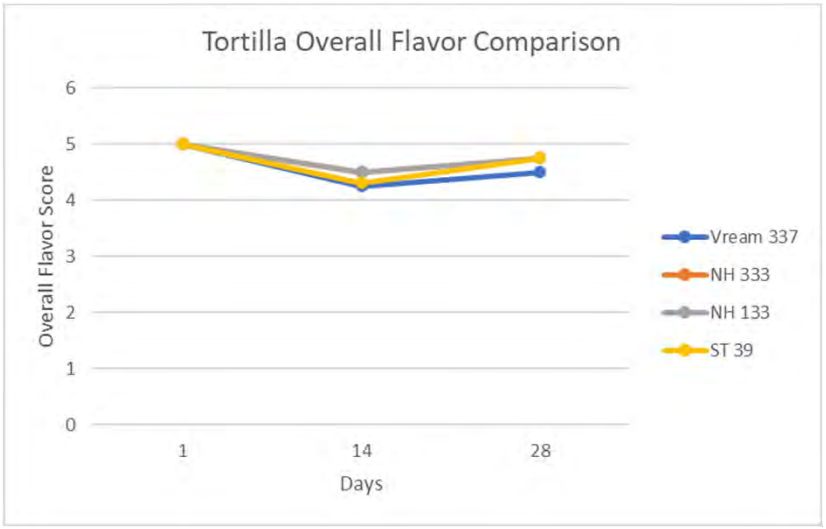
Sensory Results

- The tortilla's Overall Flavor Score decreased in the initial 14 days and slightly rebounded between the 14th and 28th day
- Overall, there is no significant flavor difference between emulsified tortilla shortening and all-purpose shortening



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Lecithin in Tortillas

Lecithin provides a multitude of benefits in tortillas

Processing

- Lecithin's surface-active nature ensures **even mixing** of ingredients and improves **rheological properties** of tortillas.
- It promotes **flour hydration**. This increases process efficiency, resulting in **less wear and tear** on production equipment.
- **Improved handling & machinability** (e.g., reduced stickiness), reduces waste and **increase product output.**

Final product quality

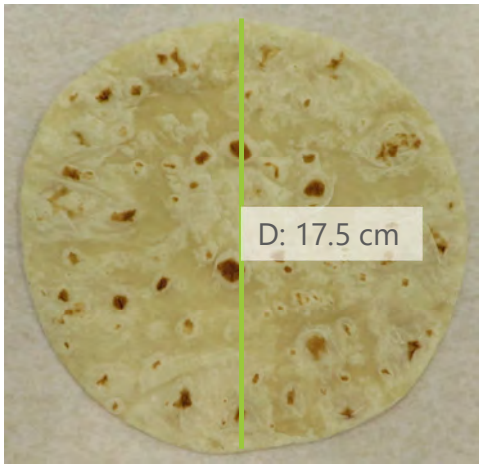
- It helps to **produce firm and extensible** tortilla with **larger diameter** without impacting yield and profitability.
- It **improves the rollability** during shelf-life and produces tortillas with **enhanced appearance.**

Shelf-life

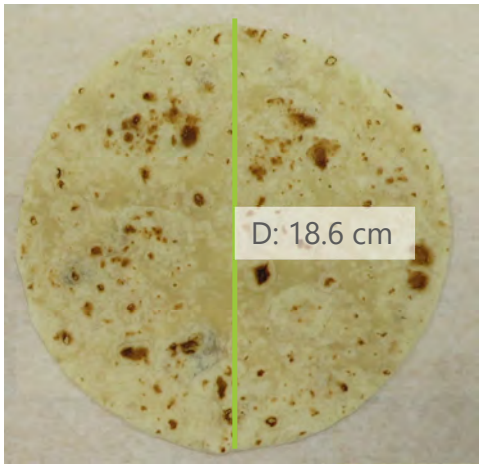
- Lecithin provides **improved shelf-life stability** by slowing of the staling process.
- It helps to **retain the fresh characteristics** of tortillas during storage.
- By improving the **extensibility and elasticity** of the dough lecithin can extend the shelf life of tortillas

Dough extensibility test

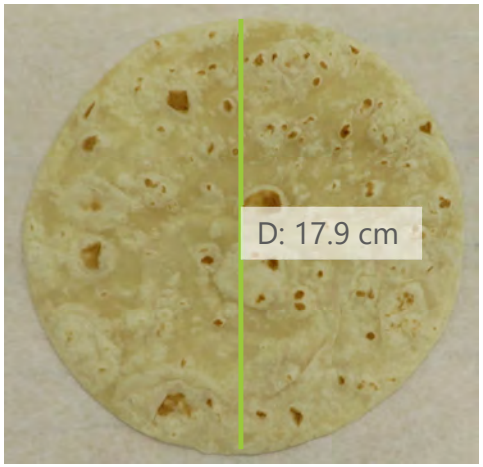
- Tortillas physical dimensions
  - High quality tortillas have a greater diameter
  - The higher the specific volume the greater the number of produced tortillas per batch



Mono- and diglycerides



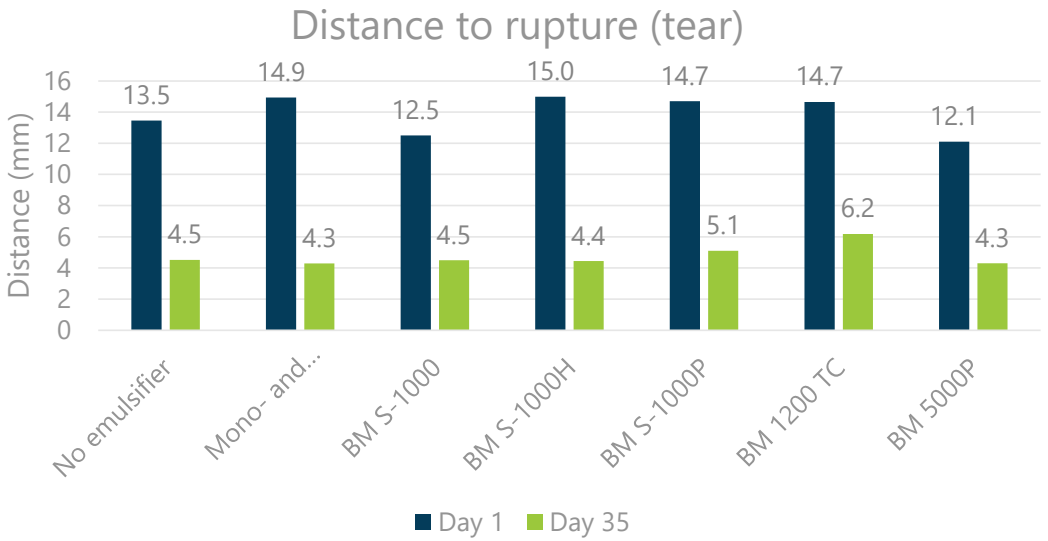
BM S-1000P



BM S-1000

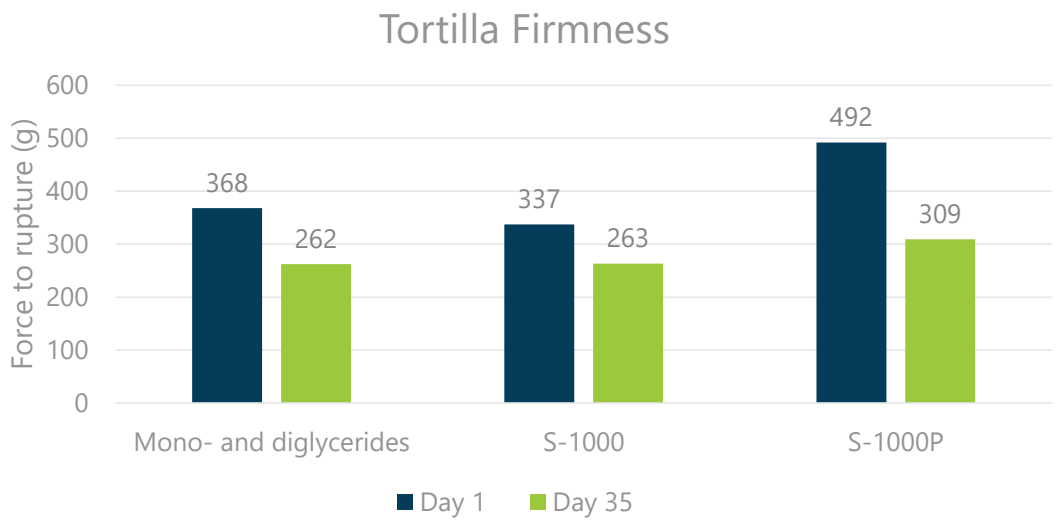
Extensibility

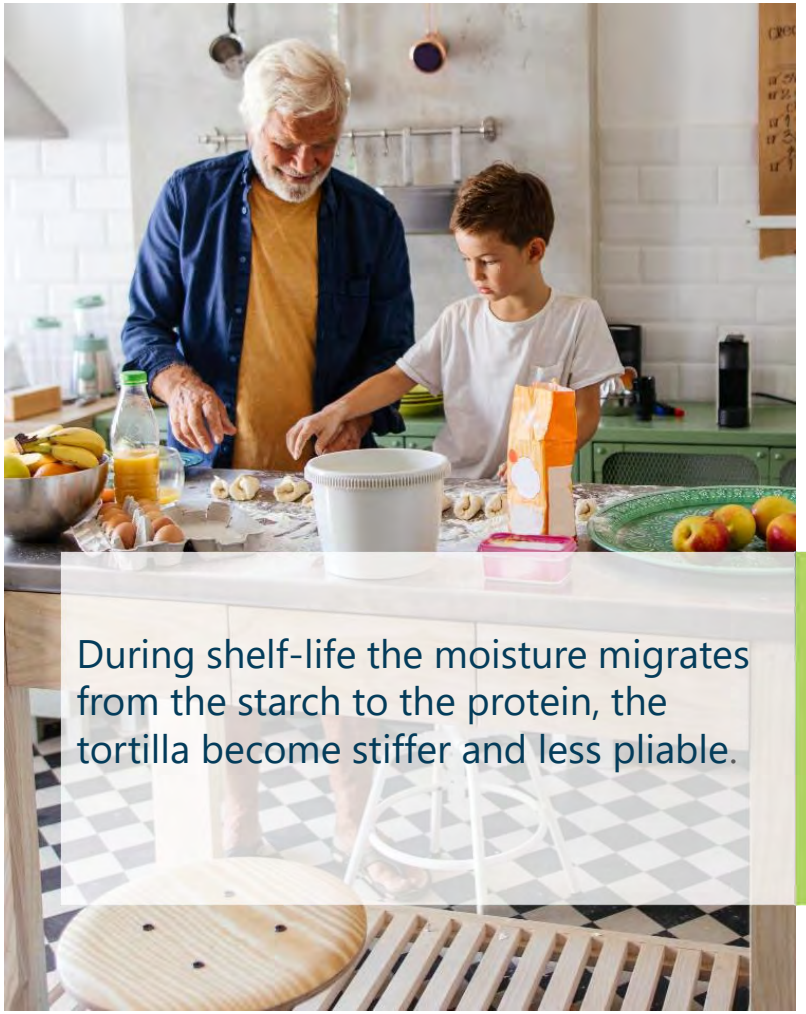
- The extensibility was measured by Texture Analyzer
  - Resistance to extension (Force and Distance)
  - Rupture (Force and Distance)
- The distance to rupture deceases during storage



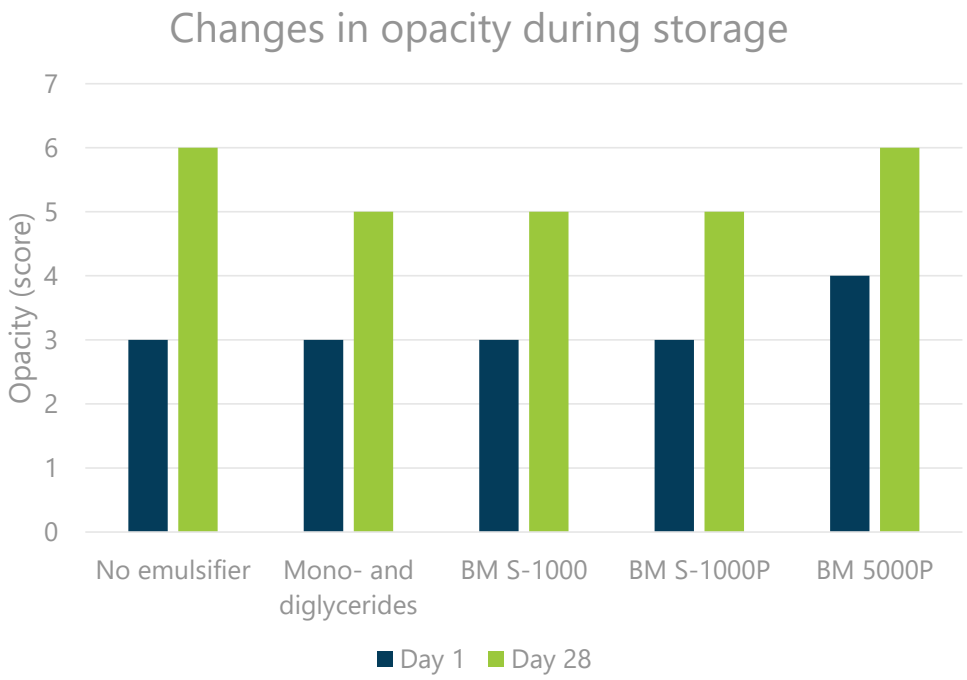
Tortilla Firmness

- The force to pull the tortilla apart is decreasing, and due to the staling it rips sooner.
- The force is decreased incase of all samples, but at a lower rate in samples which contains emulsifier or lecithin.



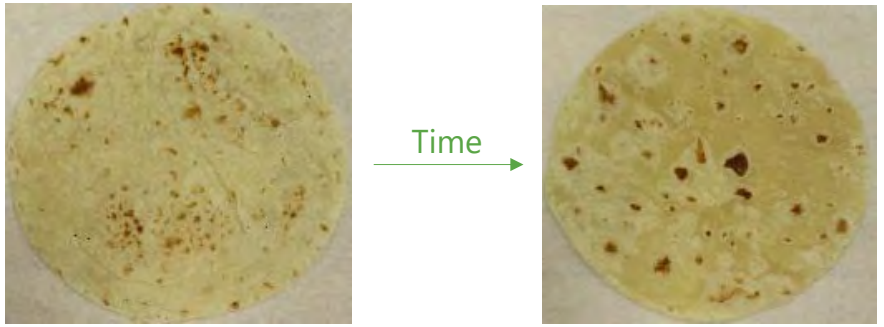


Tortilla Opacity



Tortilla physical properties: Opacity /Translucency:

- High quality tortillas have a high Opacity; excessive Translucency is sometimes considered a defect, though some translucency is natural and widely accepted.
- Tortillas made with de-oiled sunflower lecithin (BM 1000P) and Mono-and Diglycerides (E471) remain the most opaque during a shelf-life of 28 days.



Summary -Technical benefits of lecithin in tortillas

- **Increased processing efficiency**
  - In dough processing, lecithin not only acts as a **mixing aid** that facilitates the distribution of minor ingredients, it also **promotes flour hydration** which increases process efficiency,

- **Excellent dough conditioning**
  - Lecithin also functions as a dough conditioner, **aiding gluten formation** and **improving dough extensibility**. Its conditioning properties facilitate dough processing by preventing under or overdevelopment .
  - Lecithin also maintains uniform moisture throughout processing helping to avoid surface drying.
  - At the same time, it **reduces dough stickiness** and enhances machinability. The result is uniform dough balls with fewer doubles, increased sheetability with reduced risk of tearing, and consistent tortilla shape.

Summary - Technical benefits of lecithin in tortillas

- **Enhanced appearance, size and shape**
  - Lecithin enhances the appearance of tortillas by improvements in opacity and minimizing translucency.
  - This effect is seen directly after production, and especially after about half the shelf life, lecithin improves opacity by 10% or more compared to tortillas without emulsifiers.
  - Manufacturers can produce tortillas that are 5% **larger in diameter** compared to tortillas made with standard grade emulsifiers, without compromising the weight or number of tortillas produced per batch.
  - By **improving the extensibility and elasticity** of the dough lecithin can extend the shelf life of tortillas.

Application: Tortilla Chip Frying

- **Chemistry of Frying**
- **Industrial Frying Characteristics**
- **Frying Oil Requirements**
- **Oil Types - Options**

Chemistry of Frying

- Reactions that happen when Frying:
    - Browning (carmelization)
    - Gelatinization (starches)
    - Maillard Reaction (proteins / sugars)
        - All these processes help to develop desirable flavors and colors in the food

Chemistry of Frying

- The Most Important Effect When Frying:

- Moisture Exchange
  - Food gives up WATER (steam)
    - Moisture reacting with the oil molecules results in breakdown of the oil, measured by the buildup of Free Fatty Acids in the oil.

  - Food takes on OIL (**ABSORPTION**)
    - Absorption in some chip products is 20 – 30% of the finished product weight!

  - The Fat becomes a Major Part of the Food.

  - **Shelf Life then becomes dependent on the quality of the frying oil**

Industrial Frying

- Frying Oil Requirements
  - High Oxidative Stability (resistance to Oxidation and Hydrolysis)
  - Good Flavor Stability over time
  - **Fried Products often require long shelf life of finished product**
    - Means the oil quality going out in the product, **must** be very good

Industrial Frying Options

- **Tortilla Frying Options**

• **Liquid Soy or Canola with Additives**	**$**	**May benefit from antioxidants**
• **High Stability / High Oleic liquid oils**	**$$$**	**Excellent stability in frying and shelflife**
• **Palm + Palm Fractions**	**$$**	**Solid fat levels can affect eating quality**
• **Corn and Cottonseed oils**	**$$$**	**Often see cost and availability issues**
• **Palm Super Olein**	**$$**	**Good oxidative stability – some differences in frying performance.**

For Frying, Palm Olein Performs Similarly to Soy

Palm Olein Performs Operationally

- Maintain Operating Costs & Menu
  - Works in the same applications
  - Similar fry oil life/oil stability
  - Parity to better cleaning time

Palm Oil Performs – Eating Experience

- Expert Sensory Panel Conducted Fry Evaluation
  - Compared fries fried in palm & soy oils
  - Slight sensory differences in head-to-head test
  - Palm Olein = good replacement for soy

How are Palm-Based Oils Different from Seed Oils (Soy and Canola) ?

Storage

- Super palm olein contains some solids at ambient temperatures. At cooler ambient temperature, more solids can form. Recommended storage temperature is 70-85 °F.
- Manufactures will need heated tanks in order to maintain 100% liquid product & flowability.
- Storage tanks should have agitation to help prevent localized heating of the product.

Nutrition

- Palm and soy oils are both 100% fat and deliver the same calories
- Differences exist in the amount and type of fatty acids contained in each oil
  - Soy is higher in ***polyunsaturated*** fat, essential fats found in foods that are required for normal body function
  - Palm is higher in ***monounsaturated*** fat which has been associated with the Mediterranean region (olive oil) which enjoyed a lower rate of heart disease despite a high fat diet.
  - Palm is also higher in ***saturated*** fats which The Dietary Guidelines for Americans recommends limiting to less than 10% of calories per day

Color & Functionality

- Super palm olein and other palm oils are typically higher in red color pigments – these pigments can add a **richer red** tint to the oil. The oil is processed to reduce the color.
- Palm-based oils can provide unique benefits not found in all vegetable oils. It is a highly functional/versatile ingredient for baking or frying applications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Thank You