EUROPE TECHNICAL CONFERENCE

Enzymes and emulsifier replacement in wheat flour tortilla

Cristina Primo Martín
AB Mauri
2019

Our Business

AB Mauri - A customer driven business with two major global segments: Yeast & Bakery Ingredients

ownership

32 countries

Customers

Consumers

products

45% bakery ingredients

40% yeast

15% other ingredients

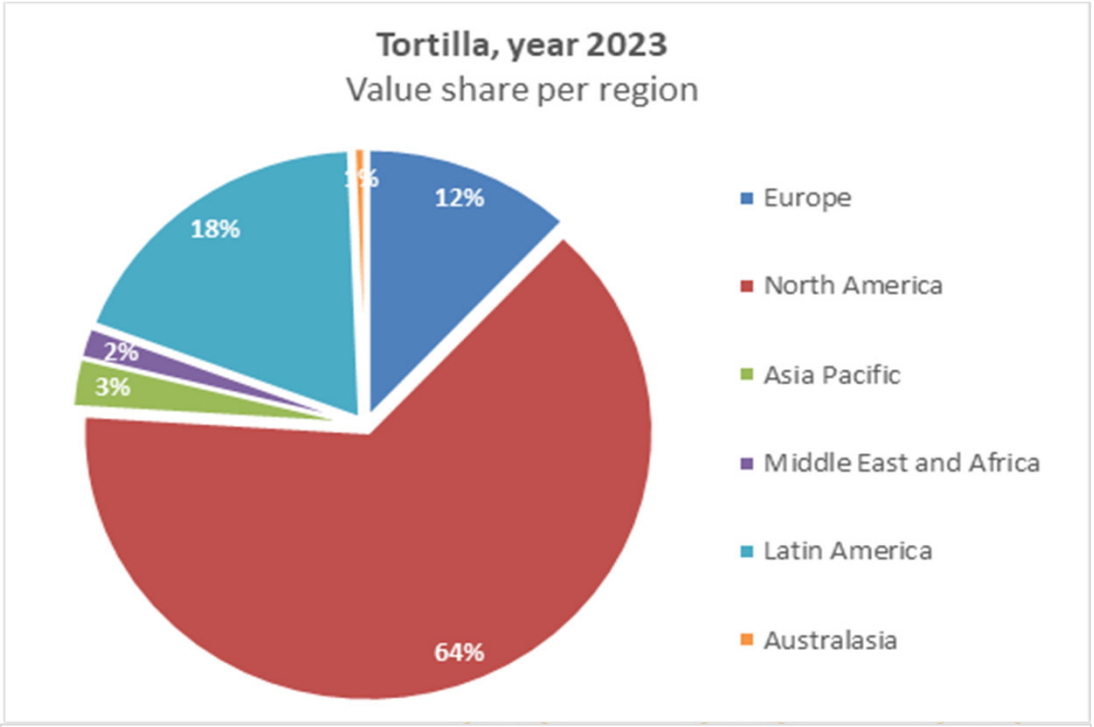
markets

95% bakery

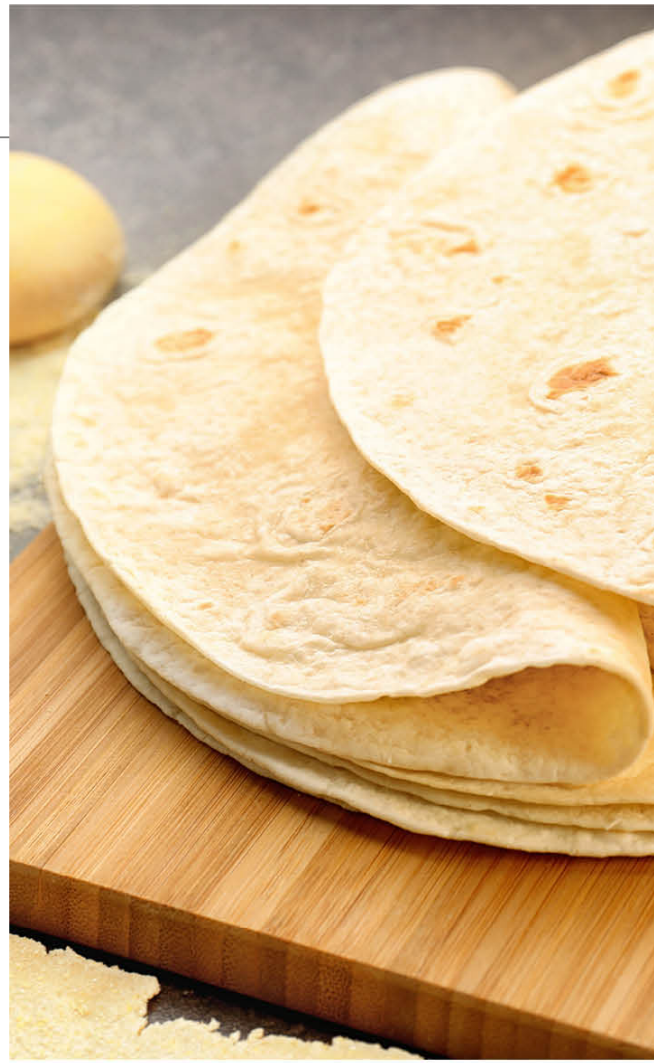
5% AB Biotek

AB | MAURI

Tortilla



Tortilla market in Europe growing 8% per year with an expected value share of 12% in 2023



Markets&Markets + Euromonitor + AB Mauri GBI estimates

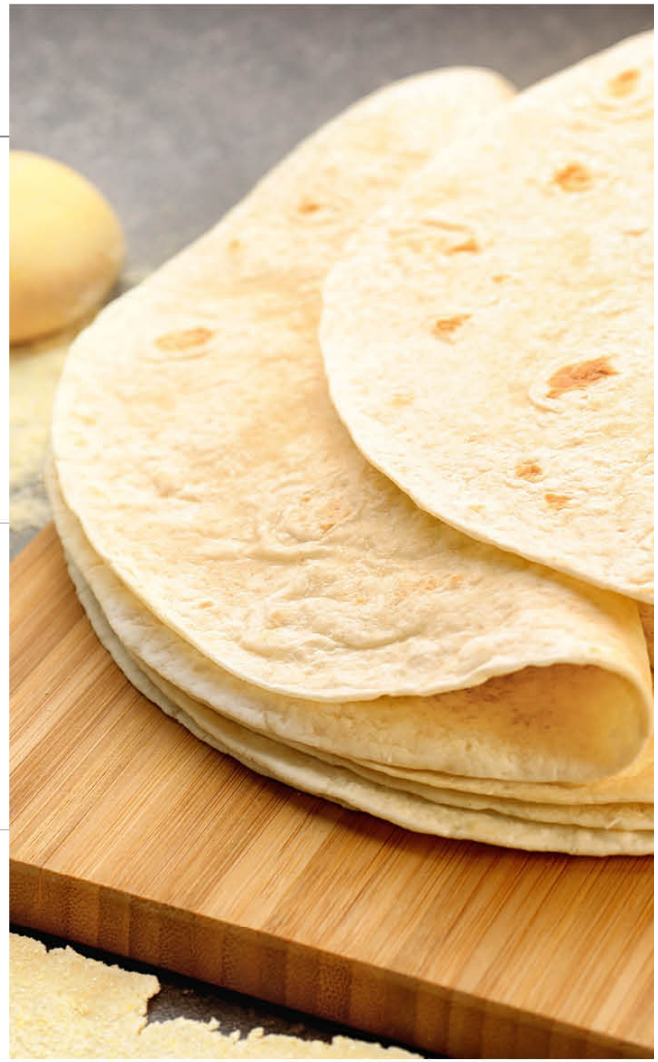
Tortilla

The challenge:

A great quality tortilla
- low fat tortillas with the same eating and textural qualities

For customers
- longer shelf life
- pressable dough
- round shaped product
- flexibility
- foldability

For consumers
- looks fresher longer
- healthy product
- low fat
- clean label
- without emulsifier
- innovation (wholegrain, multigrain, gluten free)
- a good rollability



AB MAURI
Global Bakery Ingredients

Tortilla the main challenges

Wheat Flour Tortilla Quality

- A soft and silky texture
- Excellent rollability
- Resistance to cracking
- High degree of opacity (no translucency)
- Appearance: uniform, round shape, toast points, small blisters
- Excellent fluffiness
- (layered structure)
- Optimal shelf life (no moulding)
- Ease of separation

Trends in Wheat Flour Tortilla

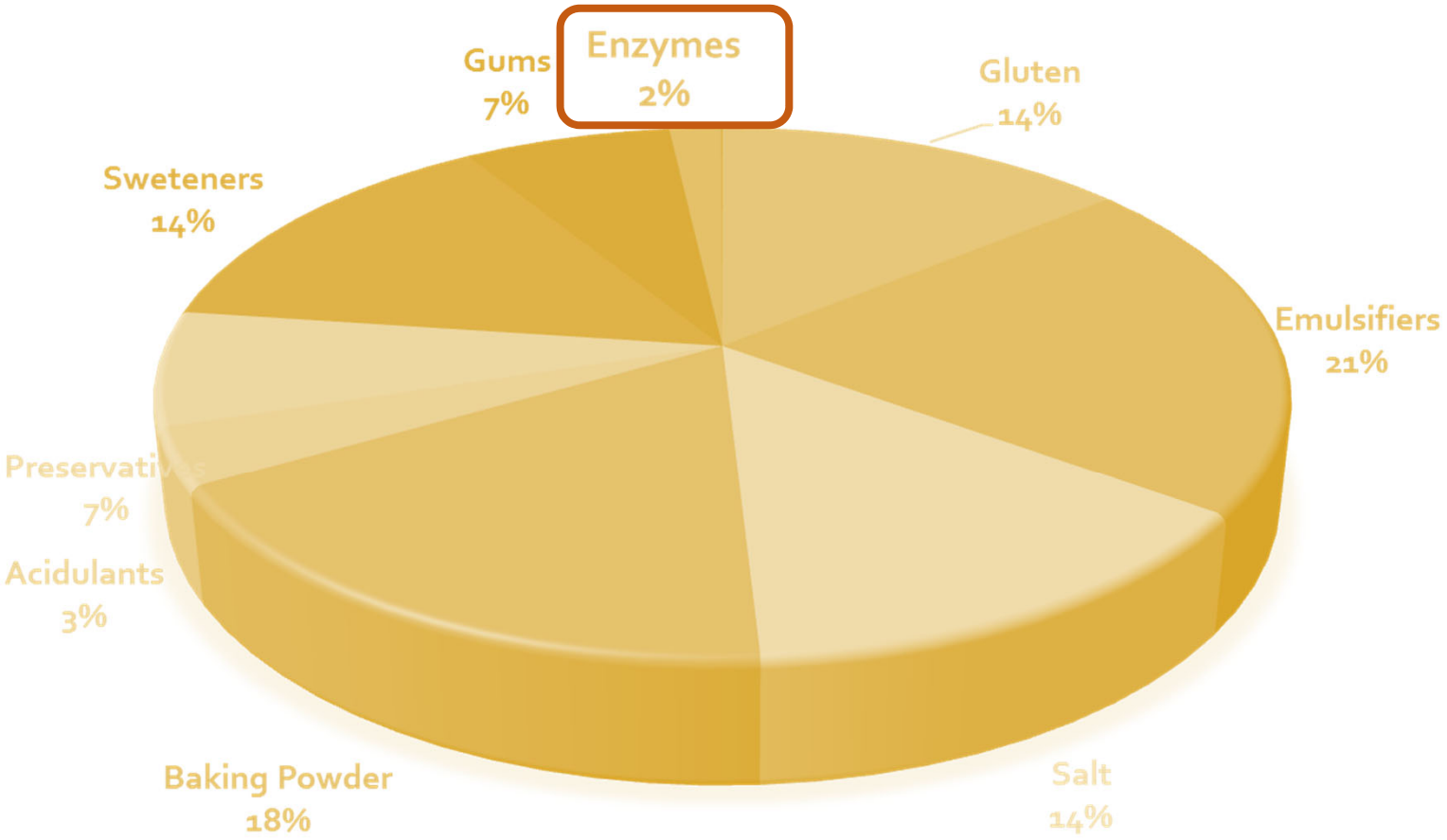
A diverse sector developing interesting products

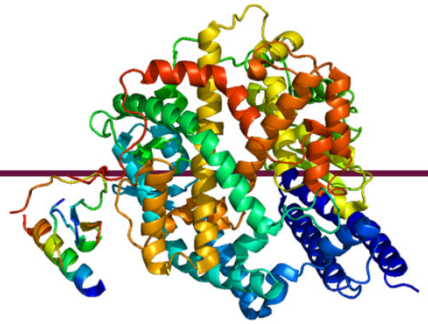
- **Health** is an area that keeps growing in Bakery: added fiber, low carb is the most successful among consumers.
- **Flavour:** a key trend throughout bakery
- **Wheat alternatives:** to offer an alternative to wheat and to provide texture, flavour and a range of nutritional benefits that are appealing to a global audience.

Source: Mintel

Basic Industrialized Wheat Flour Tortilla Formula.

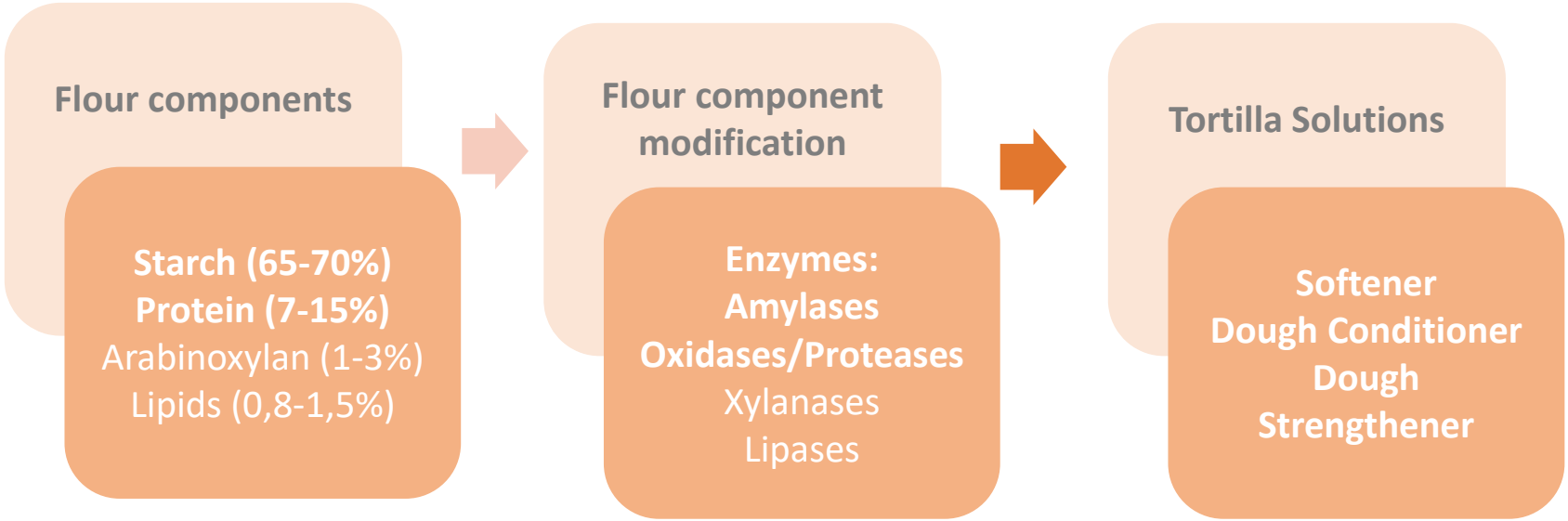
Batch pack composition

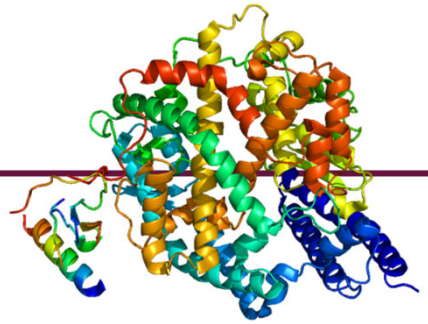




Enzymes

Enzymes in Wheat flour in tortilla processing: What are the needs?

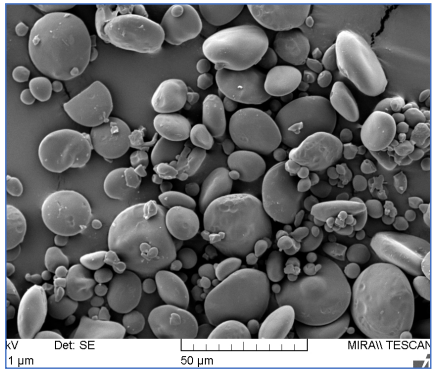


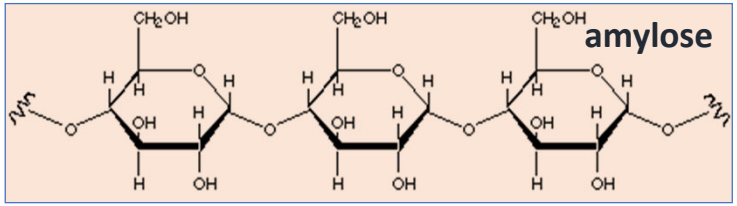


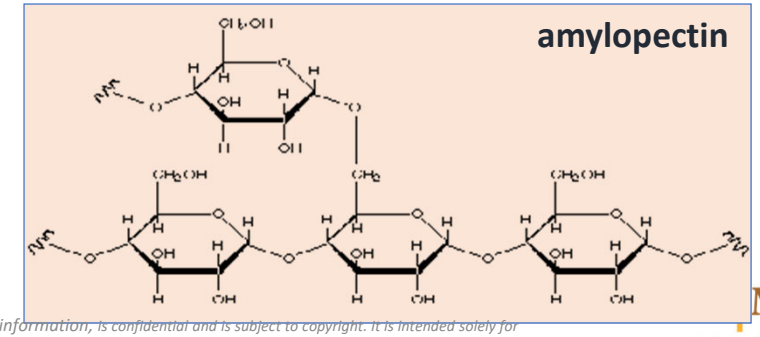
Starch and Amylases

Wheat flour in tortilla processing: Starch

- Starch is a reserve polysaccharide with granular structure: round and lenticular shape, sizes of 2 -10 and 20-35 µm
- Composition: the two major components of regular starch are:
  - Amylose (15–25%) and
  - Amylopectin
- Amylose is an amorphous linear glucose polymer
- Amylopectin is a semi-crystalline branched glucose polymer
- Native starch – intact starch granules
- Damaged starch – water binding, available to enzymes before starch gelatinization



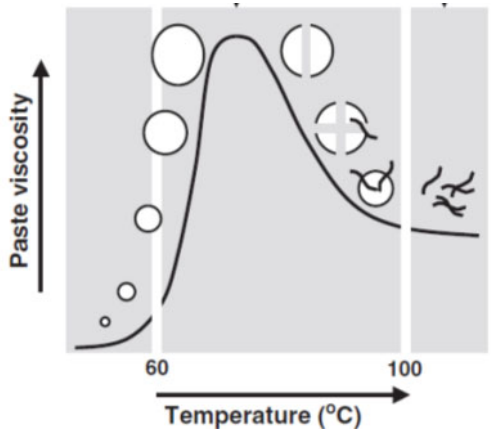




Wheat flour in tortilla processing: Starch

Changes occurring in the starch during baking affect functionality:

- Baking: hydrothermal treatment because of the presence of water and heat during baking
- Starch absorbs water and swells and loses part of its crystalline structure during baking. This process is called Gelatinization and influences product texture. Limited gelatinization, depends on amount of water and temperature and duration of the baking process.
- Gelatinized starch is accessible to **enzymes.**



Starch gelatinization

- Swelling
- (limited) Amylose leaching from the granule, granule remnants: swollen and enriched in amylopectin
- Loss of crystallinity
- Viscosity increase

Wheat flour in tortilla processing: Starch

Changes occurring in the starch during baking affect functionality:

- After gelatinization starch tends to regain crystalline structure: Retrogradation
- **Negative effect on shelf life (staling): Fresh tortillas have good foldability but during storage, tortillas get harder and loses foldability.**
  - Amylose retrogradates fast after baking (≈ 30-60 min)
  - Amylopectin retrogradation starts one day after baking

Native starch | Gelatinization | Amylose retrogradation | Amylopectin retrogradation

Enzymes in Tortilla – Amylases

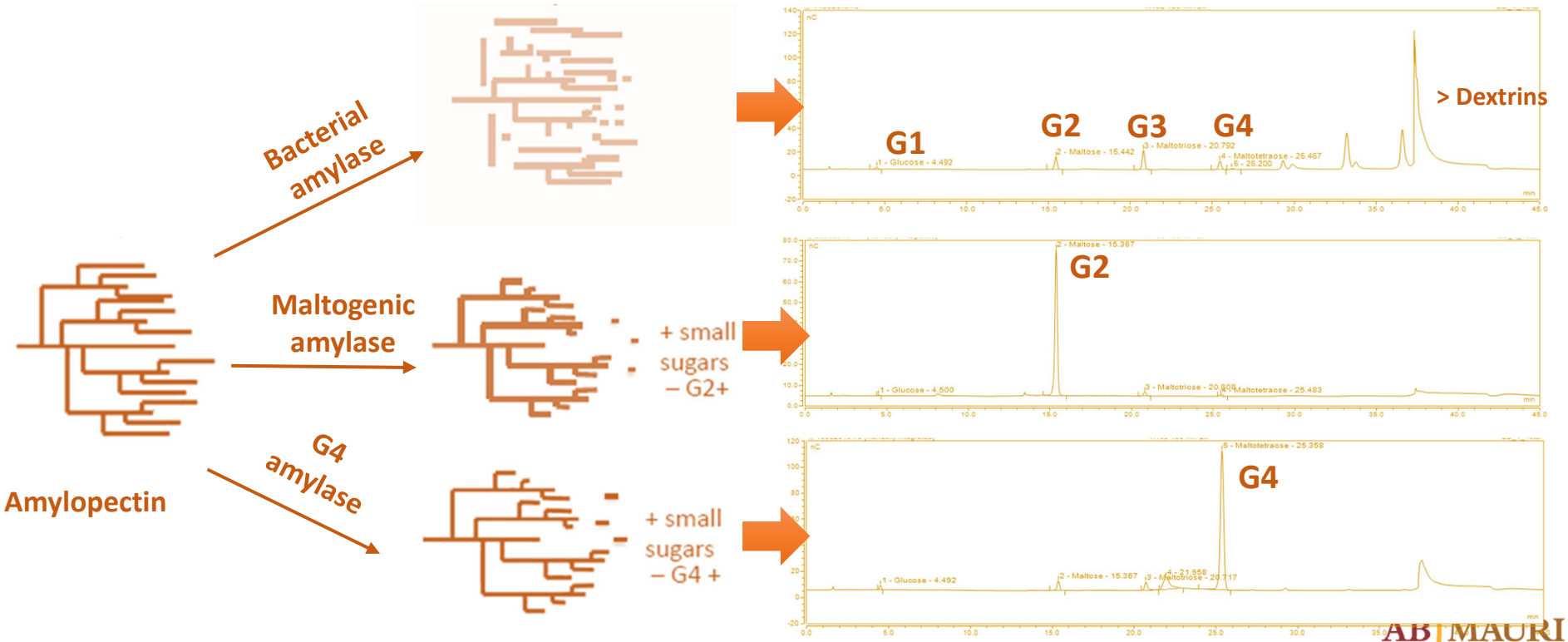
Amylases - Starch modifying enzymes

- **Fungal a-amylases, bacterial a-amylases, maltogenic amylases, maltotetraose forming amylases**
- Amylases can act on damaged starch and on gelatinized starch. Their action pattern on amylopectin is impacted by its branched structure
- Changes in starch during baking and storage affect product texture: Starch is (partly) gelatinized in tortillas and its retrogradation during storage is responsible of the loss of tortilla foldability.
- **Texture properties can be affected by modifying starch structure: A limited starch breakdown is needed to give the tortillas the required strength and eating properties (bite, chewiness)**
- Different types of amylases have different modes of action and different effects on tortilla quality

Anti-Staling Enzymes – Amylase Mechanism

Measurement of mono-, di- and oligosaccharides

- Dionex - High Performance Anion Exchange Chromatography (HPAEC) to quantitatively measure levels of mono-, di- and oligosaccharides.
- Determine levels of maltose and malto-oligosaccharides to understand differences in mode of action of anti-staling amylases

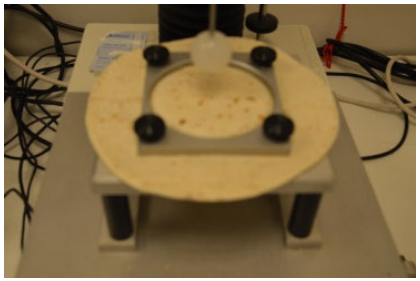


Enzymes in wheat flour tortilla – Amylases

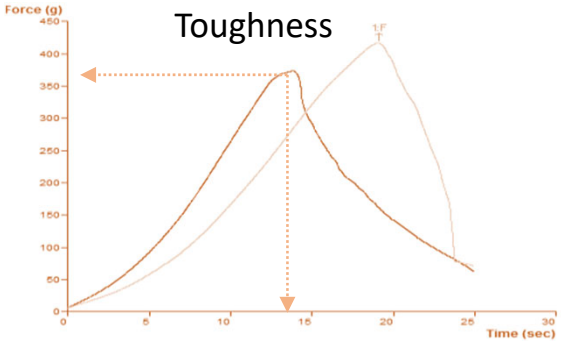
Measurement of the effects of amylases on tortilla quality

- Effect of amylases on foldability, rollability
  - – Hand measurement

- Effect of amylases on foldability, rollability
  - – Instrumental measurement



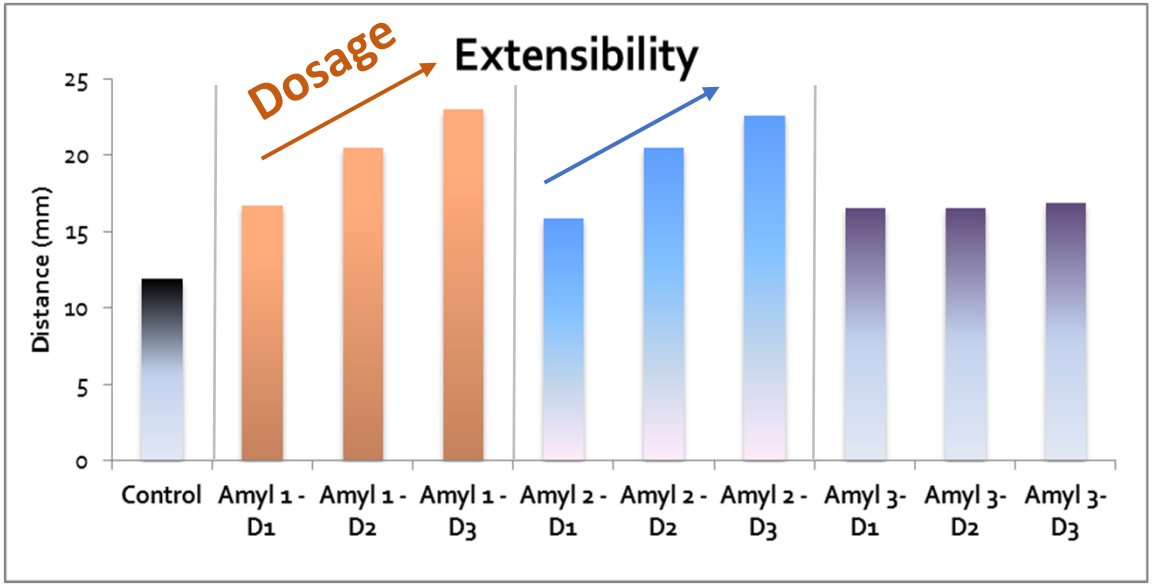
Extensibility relates to foldability

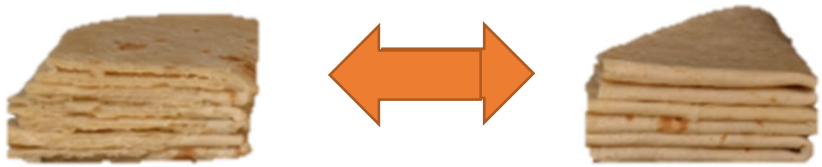


Enzymes in wheat flour tortilla – Amylases

Measurement of the effects of amylases on tortilla quality

- Amylases improve the **foldability** of wheat flour tortillas during shelf life.
- Effect of amylases depends on the **type** of the enzyme and the **dosage**.



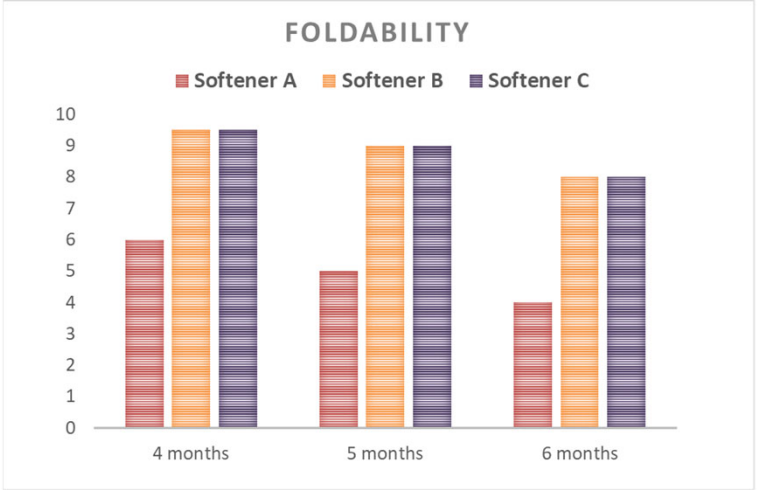


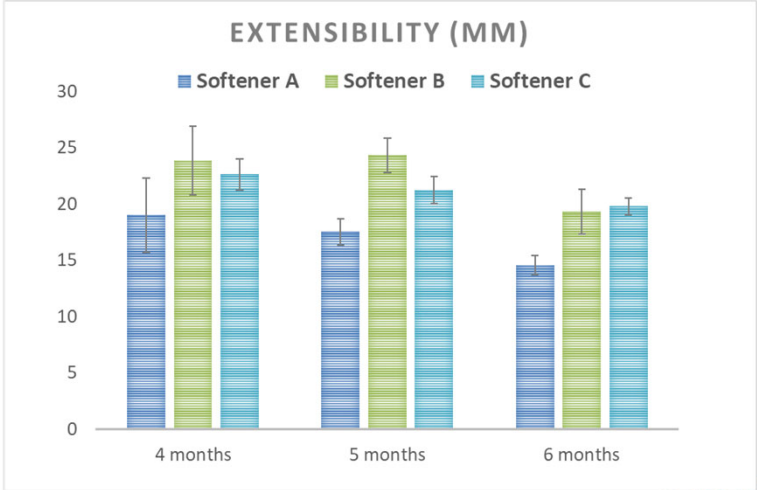
Control Amylase

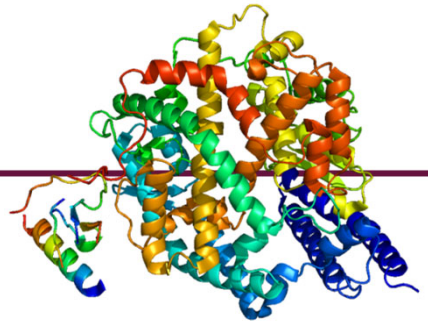
Enzymes in Tortilla - Amylases

Foldability over tortilla shelf life – 6 months

- Different types of solutions can be selected based on the shelf life of the tortilla.
- Foldability, stickiness and eating characteristics (short tender bite, no gumminess) considered.
- Similar trends between foldability (hand measurement) and extensibility (instrumental measurement).
- **Softener tortilla solutions are key to improve the shelf life of wheat flour tortilla's.**







Gluten and Gluten modifying enzymes

Wheat flour in tortilla processing: Proteins

Protein content/quality

- Wheat flour is used for many products (bread, cake, tortilla, pasta, noodles,…).
- Properties of flour components, specially gluten, determine its functionality - end use.
- Influence on tortilla quality and shelf stability:
  - Enough gluten strength to keep the dough together, shrink-proof when flattened and baked.
  - Good flexibility: Good foldability and rollability of tortillas that do not break while folding/rolling.

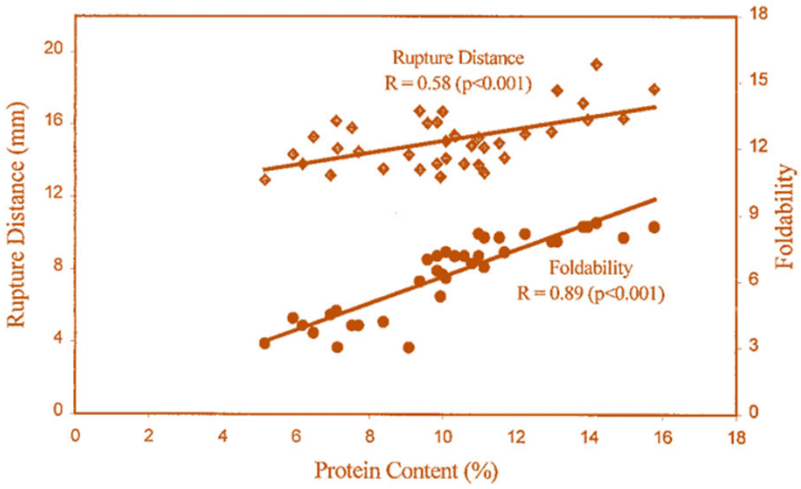
Manufacture process	Protein content	Flour treatment
Hot press	9.5 – 11.5 %	Reducing agents/proteases
Die-cut	11.5 – 14%	Oxidants
Hand-strecht	10.0 – 11.5%	

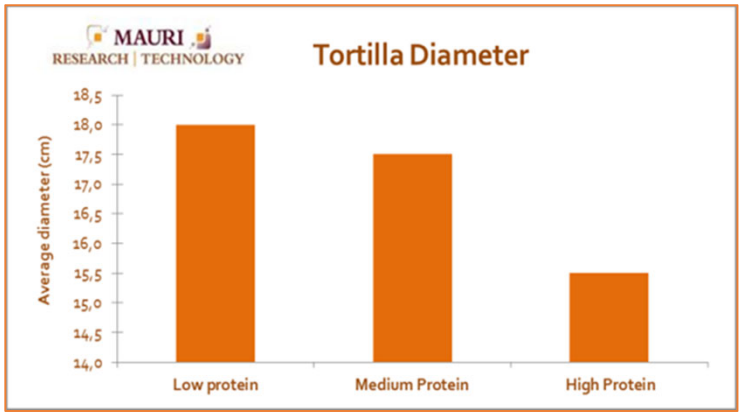
Wheat flour in tortilla processing: Protein

Relationship flour protein with tortilla quality

Protein content → predictor of tortilla quality

- Low protein content (< 9%):
  - gives tortillas that crack easily
  - larger diameters
- High protein content (> 12%):
  - better foldability
  - but too long mixing and resting times
  - smaller diameters





Enzymes in Tortilla – Gluten modifying enzymes

Gluten modifying enzymes: Proteases and Oxidases

- Gluten network affects dough properties (extensibility, elasticity, gas retention).
- Gluten influences shelf stability and flexibility of the tortilla.
- Medium gluten strength is required for tortilla making:
  - Strong flour, very elastic gluten network → dough shrinkage and irregular shaped tortillas.
    - **Proteases**
  - Weak flour, low quality gluten → lower flexibility and rollability of the tortilla.
    - **Oxidases**

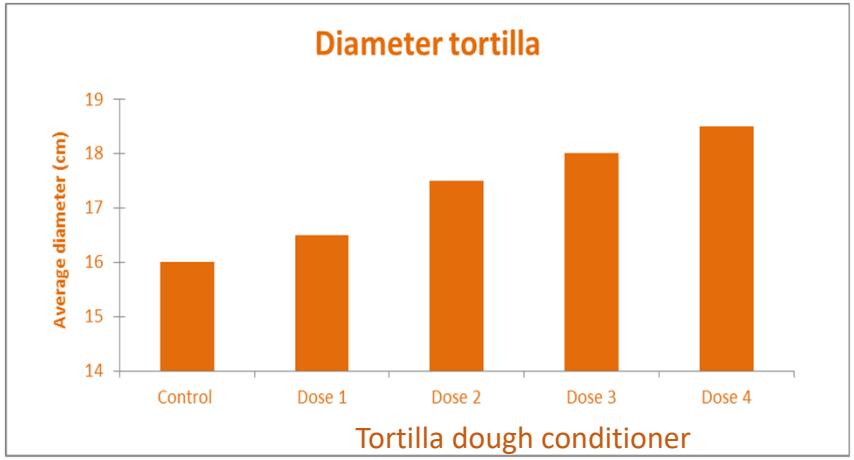
A balance between a weak gluten during processing and a strong gluten in the final product.

Enzymes in Tortilla – Gluten modifying enzymes

Tortilla Dough Conditioner

Tortilla Dough Conditioner

- For flours with high protein content/quality
- Reduces mixing time
- Improved dough handling: extensibility & machinability
- Consistent shape
- Control of tortilla diameter
- Label-friendly solution without L-cysteine



40 ppm L-Cysteine

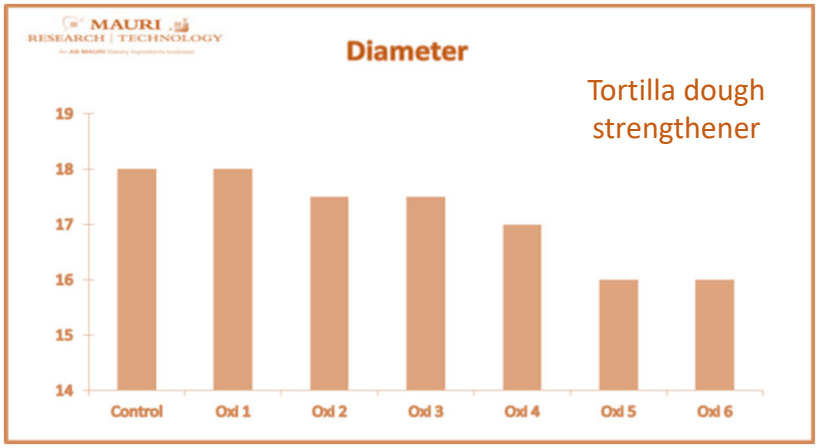
Tortilla dough conditioner

Enzymes in Tortilla – Gluten modifying enzymes

Tortilla Dough Strengthener

Tortilla Dough Strengthener

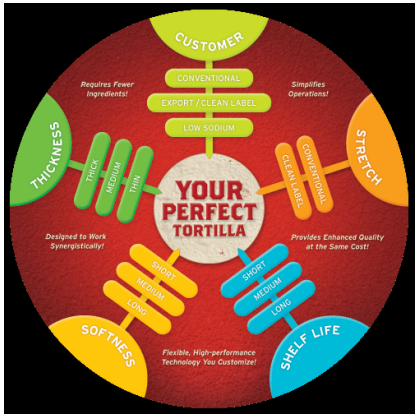
- Upgrades low quality flour/gluten
- Delivers doughs with better dough stability & machinability
- Control of tortilla diameter
- Improve foldability/extensibility of the tortilla



Tortilla Enzyme Solutions Range – features & benefits

The use of enzymes in tortilla's is key to improve the processing attributes and the shelf life of the tortilla's.

Formulation capability is key to develop the right tailored made improver.



Tortilla
Dough Conditioner

- Improved dough handling
- Better extensibility
- Control of tortilla diameter
- Consistent shape
- Cysteine replacer

Tortilla
Dough Strengthener

- Improved dough handling
- Low flour quality improver
- Good foldability
- Good processing
- Consistent shape

Tortilla Softener

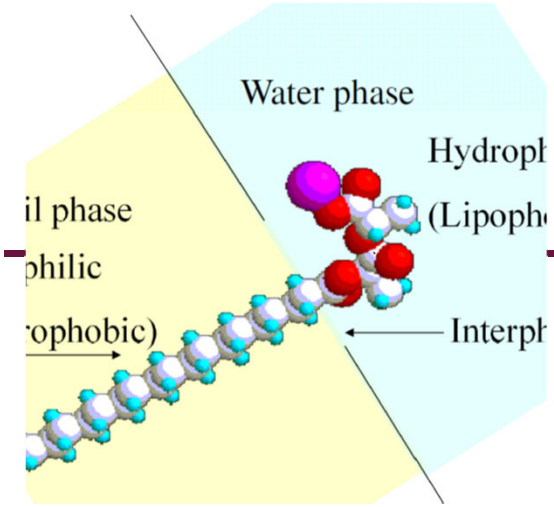
- Better fold and rollability
- Less cracking
- Shelf life extension
- Softer and moister eating

Premium
Tortilla Softener

- Better fold and rollability
- Less cracking
- Long shelf life extension
- Softer and moister eating

Confidential

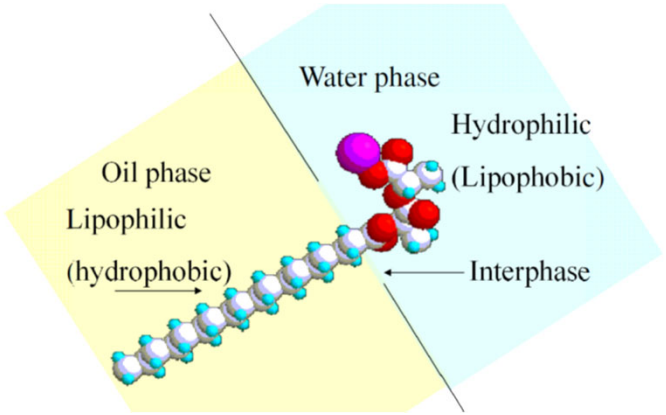
AB MAURI
Global Bakery Ingredients



Emulsifier replacement

Emulsifiers in wheat flour tortilla

- Emulsifiers: molecules with a hydrophilic (=water-loving) head and a hydrophobic (=oil-loving) tail. Emulsifiers can prevent phase separation of oil and water when they coexist in a product.
- Types of emulsifiers:
  - **Mono and diglycerides**
  - SSL, CSL
  - DATEM



- Functionality of emulsifiers in wheat flour tortilla:
  - Improve tortilla quality (foldability, moisture retention, dough rheology)
  - Amylose-lipid complexes
  - **Reduce tortilla stickiness**

Stickiness of wheat flour tortillas

- Stickiness is a big problem in the wheat flour tortilla industry.
- Problem becomes bigger for long shelf life tortillas.
- Stickiness is the lack of ease of separation between the tortillas in a packaging. This results in tearing, peeling problems and zippering.
- **Mono- and diglycerides** are used in wheat flour tortillas to improve tearing quality and help prevent tortillas from sticking to each other in the package.
- Performance depends on source, particle size, iodine value,…
- **Shortening, acids and glycerin** have also positive effects on the ease of separation of tortillas.

Hypothesis for the mechanisms of Stickiness in wheat flour tortillas

Rathod 2008. Understanding the origins of stickiness in wheat flour tortillas and devising strategies to reduce it.

- Stickiness is the result of changing phase behavior as function of RH ant T and changes in the surface energy of the product.
- Sticky tortillas show lower glass transition temperatures compared to non sticky tortillas but both were in rubbery state at room temperature.
- Higher water activity of tortillas resulted in an increase in hydrophilic surface energy and more stickiness.
- Sticky tortillas had low crystallinity as compared to non-sticky tortillas. High amorphous regions in tortilla provide points for stickiness.
- Processing and baking conditions have also a key role in tortillas stickiness.

Stickiness of wheat flour tortillas

Solutions

- **Specialty fat powders can be used to enhance the ease of separation of tortillas in the package.**
  - AB MAURI STAR BASE TECHNOLOGY
- Fat powders can be used to replace **replace mono- and diglycerides**.
- Patent Granted. WO 2019/050403. Method for preparing a flour tortilla.
- They can be used in long shelf life cleaner label tortillas.
- Different types of fat powders are available, from different vegetal sources and with different types of modifications. Their physical characteristics (melting point, saturation, particle size) influence their performance.

Stickiness of wheat flour tortillas

Measurement of stickiness - ease of separation

- Packaging:
  - Stress test: vacuum packaging of tortillas
  - MAP packaging over shelf life

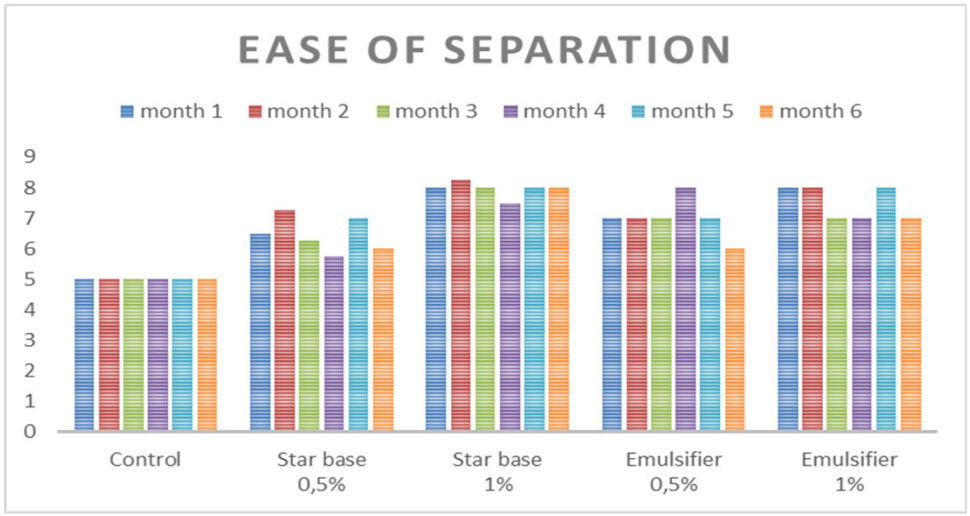
- Hand separation of consecutive tortillas in the package.

STAR BASE Technology – Anti-Stickiness solution

Ease of separation of tortillas using specialty fats – STAR BASE technology.

STAR BASE Technology

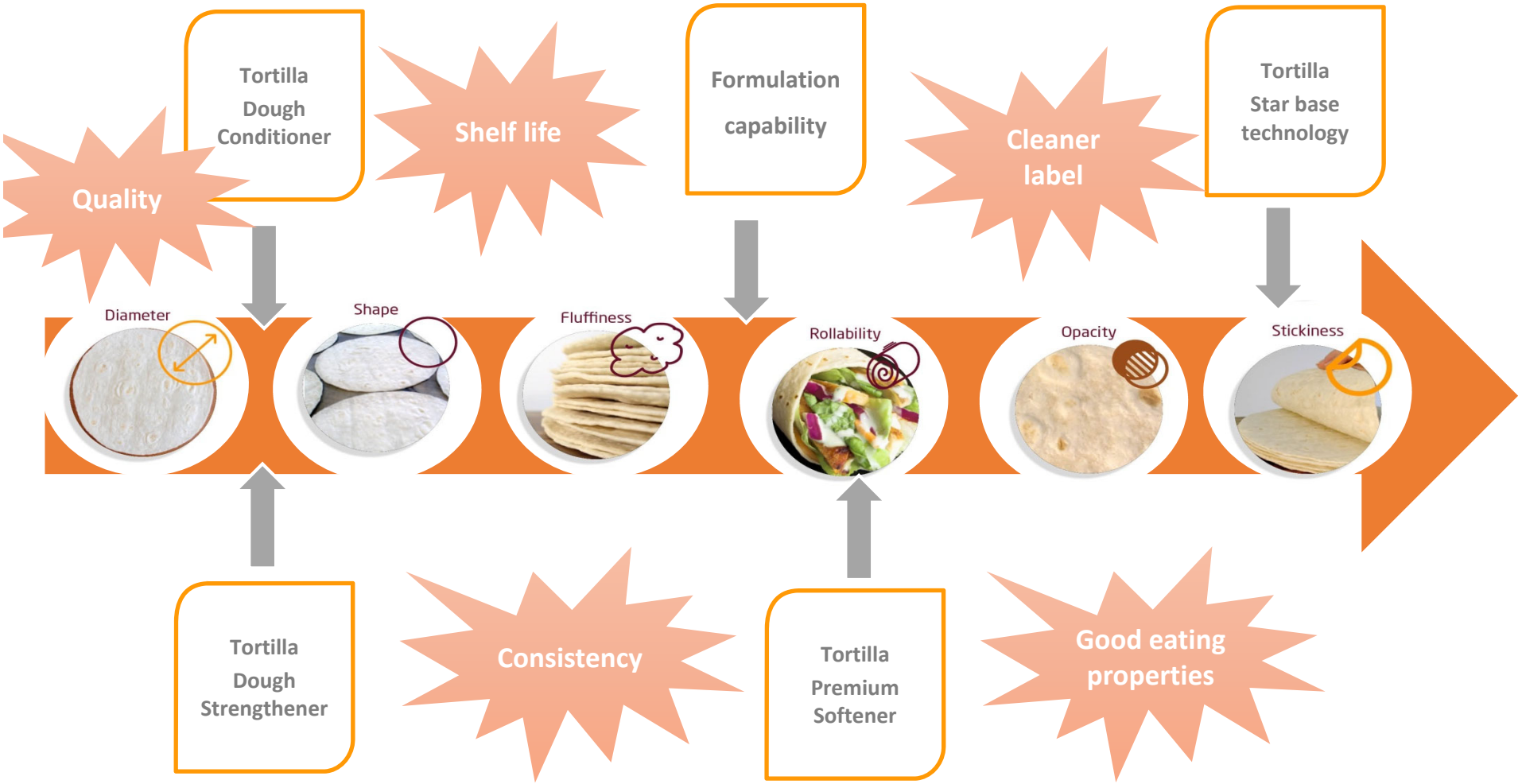
- Mono and di-glyceride replacement using specialty fat –STAR BASE
  - 0.5 – 1% dosage
- Improved ease of separation
- No broken tortillas
- Cleaner labels
- Fats from different vegetable sources, treatments and fractions available



Control Star base 1%

Patented technology (WO 2019/050403)

Tortilla Solutions Range – features & benefits



Thank you for your attention!
¡Muchas gracias!
Moltes gràcies!

Thank you to the Tortilla expertise team in AB Mauri:

Corné Dirks, John van Wortel, Emmie Dornez, Anjo Verhaart, David Lansard, Óscar Carreón