



## Extending Shelf Life of Frozen and Refrigerated Corn & Flour Tortillas

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Division of Specialty Enzymes



#### **Global Source for Enzymes & Probiotics**

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- 400+ Solutions to Improve Processes, Save Time & Reduce Costs
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#### **Fresh Tortillas**





Fresh tortillas are soft and can be rolled and folded without breaking.



## **Refrigerated & Frozen Storage**

#### Benefits



Slows microbial growth

#### Challenges

Moisture migration

#### Staling



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Fig. 21.3 Spiral freezer, self-stacking belt. (Courtesy of Frigoscandia Ltd.)

Source: Fellows, 2000

See References 1-3



#### **Challenges – Mold**



Mold may form on tortillas over time.

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#### **Challenges – Staling**



As tortillas age and stale, they may become dry and hard and undesirably break when rolled and folded.



# Challenge 1 – Moisture Migration



#### **Moisture Migration – Refrigerated Storage**





Moisture migration is a challenge due to condensation in refrigerated storage.

See References 2 and 4



#### **Moisture Migration - Frozen Storage**



Moisture migration is a challenge due to ice formation in frozen storage.

See References 1-2



## **Delaying Moisture Migration**

Packaging

#### Processing

- Cooling
- Consistent Storage Conditions
- Formulation
  - Lower Water Activity
  - Emulsifiers
  - 🧇 Gums
  - Enzymes

See References 1-4



#### **Delaying Moisture Migration - Packaging**

**Corn Tortillas - Refrigerated Storage** 

Flour Tortillas - Refrigerated Storage



1 Mil Bag (Twist Tie)

4 Mil Bag (Zipper Closure)

1 Mil Bag (Twist Tie)



A thicker package, better seal and less headspace can help delay moisture migration in refrigerated tortillas.



#### **Delaying Moisture Migration - Packaging**

Corn Tortillas - Frozen Storage



1 Mil Bag (Heat Seal)



4 Mil Bag (Heat Seal)

A thicker package, better seal and less headspace can also help delay moisture migration in frozen tortillas.



#### **Delaying Moisture Migration – Cooling**

- Cooler air holds less moisture
- Cool tortillas sufficiently before packaging to minimize condensation



See References 1-2



#### **Delaying Moisture Migration – Rate of Freezing**



Slow Freezing

**Rapid Freezing** 

Rapid freezing results in smaller ice crystals and helps minimize damage to frozen food.

See References 5 and 1



#### **Delaying Moisture Migrations – Storage Conditions**



Fluctuations in storage temperatures can cause larger ice crystals to be formed.

See References 1, 5, and 6



#### **Delaying Moisture Migration - Storage Conditions**



Minimize fluctuations in storage temperatures to help minimize moisture migration.

See References 1 and 5



#### **Delaying Moisture Migration – Storage & Ingredients**

- Frozen food stored below Tg' is more stable to ice recrystallization
- Cryostabilizers e.g. maltodextrins, proteins, gelatin, gums

Foods	Tg' (°C)
Potato starch	-5
Cod muscle	-11.7 +/- 0.6
Beef muscle	-12 +/- 0.3
Fresh potato	-12
Sweetcorn, fresh	-15
Maltodextrins, 15 DE	-16
Cheddar cheese	-24
lce cream	-31 to -33
Sucrose	-32
Glucose	-43
Glycerol	-65

Tg' data compiled from References 2, 5, and 6



# **Challenge 2 – Staling**





#### What Causes Staling?

Moisture O Protein Starch

See References 1-2 and 7-10

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## **Starch Plays a Major Role in Staling**







#### Ways to Delay Staling

- Minimize Moisture Migration
  - Packaging
  - Storage conditions
  - Ingredients
  - Degree of bake
- Minimize Reassociation of Starch & Protein
  - Storage conditions
  - Ingredients
    - Emulsifiers
    - Gums
    - Enzymes

See References 1-2 and 7-10



## **Delaying Staling – Degree of Bake**

Shorter bake – minimizes moisture loss, which helps delay staling



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See References 2



#### **Delaying Staling – Storage Conditions**

- "Rapid Staling Zone" -5°C (23°F) to 10°C (50°F)
  - Refrigeration speeds up staling
- For frozen tortillas, minimize time in "rapid staling zone" by freezing and thawing quickly
- For tortilla chips, refrigeration before frying may be beneficial





See References 1 and 3

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## **Delaying Staling – Emulsifiers**

Weight and the second secon

Interact with linear starch chains

Make initial softness softer



See References 11-12



#### **Delaying Staling – Gums**

- Heteropolysaccharides
  - Sources include seaweed & exudates of plants, and endosperm of certain plants
- Can absorb & bind water
- Prevents loss of water, which can extend shelf life



See Reference 11



## **Delaying Staling – Enzymes**

Proteins that speed up chemical reactions

Certain enzymes can help delay staling
Amylases – delay starch retrogradation



- Phospholipases improve emulsifying properties
- Xylanases act on arabinoxylans



#### **High-Performing Maltogenic Amylase**

#### Benefits

- Increases water binding
- Prolongs softness & maintains elasticity/resilience
- Extends shelf life by delaying staling
- Helps produce softer, superior-quality baked goods
- Function | Hydrolyzes maltotriose to maltose & glucose
- Itigh-Performing Maltogenic Amylase | SEBake Fresh Ultra™













#### **Tortillas – 1.5 Months Refrigerated**



Control Corn Tortillas (No Enzymes)



Control Flour Tortillas (No Enzymes)



Corn Tortillas with 100ppm SEBake Fresh Ultra™



Flour Tortillas with 100ppm SEBake Fresh Ultra™

SEBake Fresh Ultra<sup>™</sup> improved the rollability and foldability of refrigerated tortillas.



#### Tortillas – 3 Months Frozen



Control Corn Tortillas (No Enzymes)





Control Flour Tortillas (No Enzymes)



#### Corn Tortillas with 100ppm SEBake Fresh Ultra<sup>™</sup>



Flour Tortillas with 100ppm SEBake Fresh Ultra<sup>™</sup>

SEBake Fresh Ultra<sup>™</sup> improved the rollability of frozen corn tortillas.



#### **Corn Tortillas - 15 Month Frozen Storage**



Control (No Enzymes)

With SEBake Fresh Ultra™



Tortillas with SEBake Fresh Ultra<sup>™</sup> were significantly more flexible and had less curling than control tortillas after 15 months of frozen storage.



#### **Corn Tortilla Firmness – 15 Months Frozen Storage**



Corn tortillas with SEBake Fresh Ultra<sup>™</sup> were 30% softer than control after 15 months of frozen storage.



#### **Corn Tortilla Rollability - 15 Months Frozen Storage**



Control (No Enzymes)



With SEBake Fresh Ultra<sup>™</sup>

Tortillas with SEBake Fresh Ultra<sup>™</sup> stayed intact better when rolled than control tortillas after 15 months of frozen storage.



## Phospholipase

- Benefits
  - Replaces emulsifiers like DATEM, SSL
  - Can prolong softness in tortillas by improving emulsifying properties
  - Whiter & finer crumb, and may increase volume (in bread)
- Function | Hydrolyzes natural phospholipids to lyso-phospholipids
- Phospholipase | SEBake PF<sup>™</sup>





#### **Corn Tortilla Rollability - Day 150 Refrigerated**



Control (No Enzymes)

With SEBake Fresh Ultra<sup>™</sup> + SEBake PF<sup>™</sup>

Tortillas with SEBake Fresh Ultra<sup>™</sup> and SEBake PF<sup>™</sup> stayed intact better than control tortillas after 150 days of refrigerated storage.



#### **Tortilla Size - Day 150 Refrigerated**

Diameter (inches)	Control	50ppm SEBake Fresh Ultra™	50ppm SEBake Fresh Ultra™ + 10ppm SEBake PF™	50ppm SEBake Fresh Ultra <sup>™</sup> + 20ppm SEBake PF <sup>™</sup>
Day 1	5.4	5.5	5.5	5.5
Day 150	4.9	5.4	5.5	5.5

Tortillas with SEBake Fresh Ultra<sup>™</sup> and SEBake Fresh Ultra<sup>™</sup> + SEBake PF<sup>™</sup> retained their size better than control tortillas after 150 days of refrigerated storage.



#### Summary

- Refrigerated & frozen storage helps extend freshness of tortillas
- Moisture migration & staling can negatively affect the quality of refrigerated and frozen tortillas
- To extend the shelf life of refrigerated & frozen tortillas, a combination approach can be utilized to maximize benefits by making changes in formulation, processing and packaging to minimize moisture migration and staling



#### **Tips to Keep Frozen & Refrigerated Tortillas Fresh**

- Minimize moisture migration
  - Thicker packaging with stronger seal
  - Sufficient cooling before packaging
  - Cool/freeze/thaw tortillas quickly
  - Minimize fluctuations in storage temperatures
  - Ingredients to bind moisture
  - Shorter bake time
- Minimize movement of starch & protein
  - Frozen storage (if possible)
  - Emulsifiers
  - Gums
  - Enzymes





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## **Baking & Milling Solutions**

Ingredient	Products	Benefits
High-Performing Maltogenic Amylase	SEBake Fresh Ultra <sup>™</sup>	Prolong Softness, Extend Shelf Life
Maltogenic Amylase	SEBake Fresh 1.5P™ SEBake Fresh 10P™	Prolong Softness, Extend Shelf Life
Multienzyme Blend	SEBake Fresh <sup>™</sup>	Prolong Softness, Extend Shelf Life
Hemicellulase / Xylanase	SEBake AX <sup>™</sup> , SEBake BX 5 <sup>™</sup> , SEBake FX Ultra <sup>™</sup>	Smooth Dough Handling, Increase Volume, Flour Correction
Phospholipase	SEBake PF™	Emulsifier Replacement, Improve Whiteness
Fungal Amylase	SEBAmyl X100P™ SEBAmyl X5P™	Increase Volume, Softness
Lipase	SEBake L80™	Dough Strengthening, Improve Machinability, Increase Volume



## **Baking & Milling Solutions**

Ingredient	Products	Benefits
Glucose Oxidase	SEBake GO <sup>™</sup> / GO Eco™	Increase Dough Strength & Flour Stability Replace Potassium Bromate
Glucoamylase	SEBake GA 400™	Replace Sugars, Increase Volume
Cellulase	SEBake CLX <sup>™</sup>	Increase Volume in High Fiber Bread
Protease	SEBake NP™	Increase Dough Extensibility Gluten Correction in Sweet Biscuits
Protease & Xylanase	SEBake Crisp Plus <sup>™</sup>	Gluten Correction / Batter Viscosity Reduction
Papain	SEBake PP™	Gluten Correction in Fermented Biscuits, Cookies
Phospholipase	SEBake EG6 <sup>™</sup>	Egg Reduction in Cakes

## **Thank You!**



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