ANTI-STICKING TECHNOLOGY
for Tortilla Application

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Yanling Yin, PhD
Bakery Application

CORBION: Built on the solid foundation of *Caravan Ingredients* and *Purac* over a century of experience

- A leading company in functional blends containing **enzymes, emulsifiers**, minerals and vitamins.
  - Clean Label & Extended Shelf Life Solutions for **baked goods**
  - Product & Process consistence Improvement for **Bakeries**
  - Fortification for **Flour, Food and Beverage**

- Global market leader in lactic acid, lactic acid derivatives and lactides through **natural fermentation**
  - Natural preservation & fortification for **Food**
  - Biobased ingredients for **Chemical** & **Pharma**
  - Monomers for **Bioplastics**

Bakery

Meat

Confectionery

Beverage

Corbion

Main Themes from Corbion – What do we provide customers?

- Consistent Quality & Reduced Waste
- Freshness that Lasts
- Tastes that Delight
- Cleaner Labels
- Technical Service

Today Discussions

Anti-stick technology for Tortilla Application

1. Stickiness is one of the top challenges for commercially produced flour tortilla

2. Factors affect tortilla stickiness

3. Relationship between tortilla stickiness and surface energy, surface roughness, fat phase, or water migration rate.

4. *Corbion* "Bucket Test" (case study) and anti-stick solutions as well as texture improvement

Tortilla Processing - Uniqueness

- **Very fast turnaround**
  - Under **45 minutes** from flour to bag
- **Warmer Doughs**
  - 80-90ºF
- **Stressful Processing**
  - Hot Press / Die Cut / Hand Stretched
- **Fast Fast Fast…Griddle 20-40 sec**
- **One becomes Many: Stacking = Sticking**

Tortilla Uniqueness

Formulation

- Chemically leavened
- Relatively high in pH

Product Characteristics

- Eating quality
- Uses – need strength
- Shelf life

Packaging

- Individuals = One
- Surface Area / Sticking

3 Top Quality Challenges for Flour Tortilla

Staling

- Becoming firm and dry
- Loss flexibility and roll-ability

Stickiness:

- Difficulty in separating two or more tortillas resulting in tearing and peeling

Mold Growth

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Practical View – Tortilla New Technology

- "Softening" emulsifiers have been reduced/removed with success
- Gums have been reduced/removed
- Rollability and Foldability greatly improved
- Softness, Freshness, and shelf life extended
- **The potential for damage from sticking is increased!**

Factors that Affect Tortilla Stickiness

- Water Activity
- Glass Transition Temperature (Tg)
- Surface Energy
- Processing and Baking Conditions

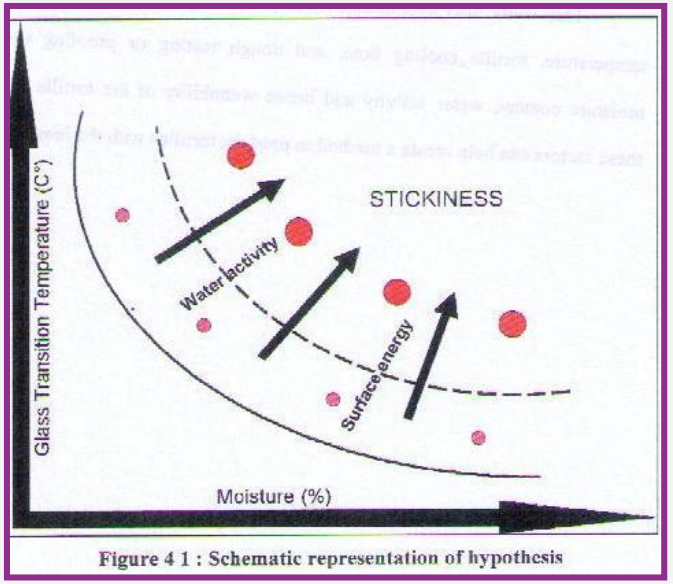

Figure 4 1 : Schematic representation of hypothesis

Traditional Fixes For Tortilla Stickiness

Process

- Increase bake time to get final moisture 30-32%
- Increase cooling time before going into refrigeration or freezing and packing
- Reduce humidity in cooling area. <70%...
- Improve way of packing and reduce # of tortilla in the bag
- Use a cardboard shelf in the box
- Flip boxes over / re-pallet!!
- Use a pallet configuration that distributes weight better

Formulation

- Reduce formula water
- Use type of fat which has minimal liquid-solid phase
- Add Emulsifier as conditioner, gluten as strengthener, gum as film former
- Use flour or starch as dusting agents
- Adjust leavening system, sugar, or other ingredients

To live with it -- defects or wastage

Corbion Anti- Stick Technology

- to alter tortilla surface characteristics

- Water Activity
- Glass Transition Temperature (Tg)
- **Surface Energy**
- Starch Crystallinity
- Processing and Baking Conditions

Hypotheses for Anti-Stick Functionality

1. **Physical modification of the tortilla surface**
   - Surface roughness – Nano or micro-scale
   - Smooth vs. rough surfaces – ease of slip; number of contact points

2. **Chemical modification of the tortilla surface**
   - Surface hydrophobicity/hydrophilicity
   - Water bridges / migration rates

Effect of Anti-Stick Technology on Surface Energy (Wet-ability)

Corbion anti-stick technology reduces the tortilla surface wet-ability.

Trancendim Product Line - Beaded Hi Diglycerid; MP: 55-70°C (131-158°F); Very Low/No Trans (IV ≈ 3); Fat Structuring

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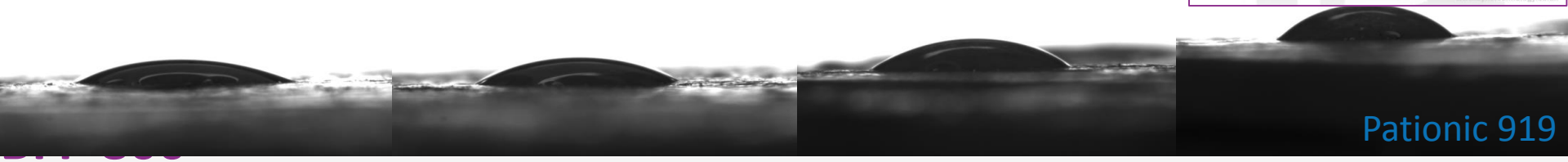
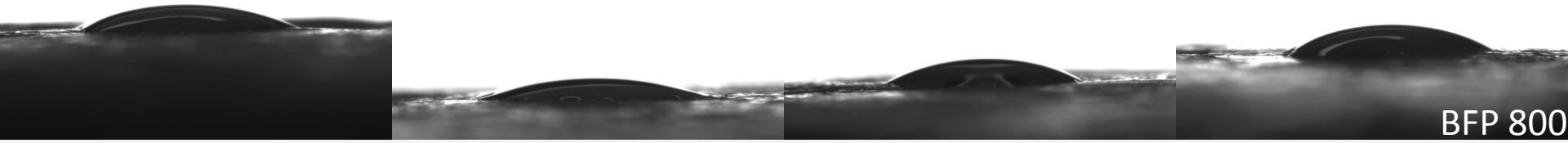
Contact Angle Measurement (with Different Emulsifiers)

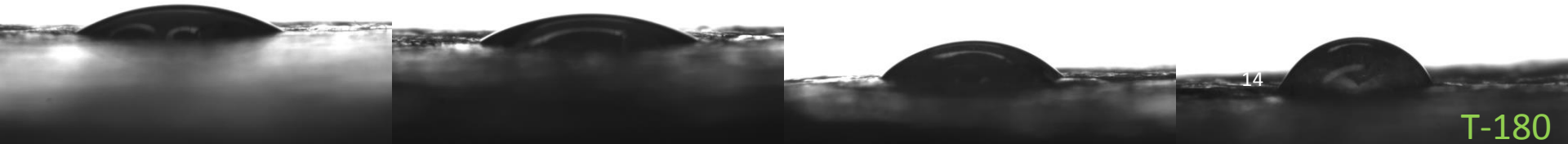
Control 1% 5%



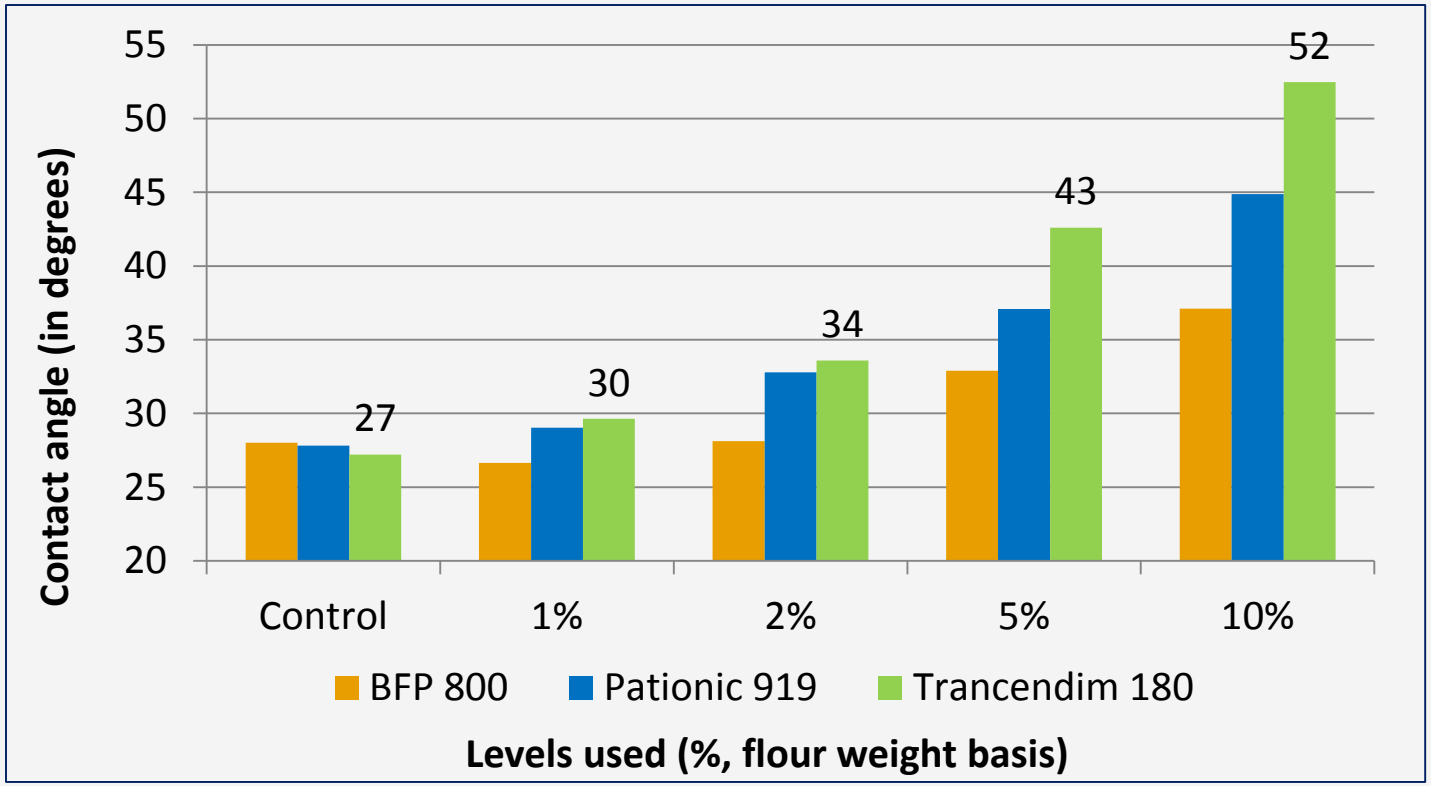
Control 1% 5% 10%

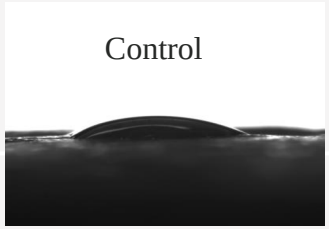


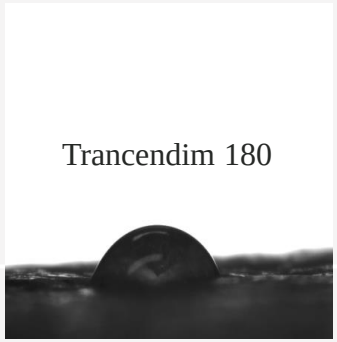
Control 1 % 5% 10 %



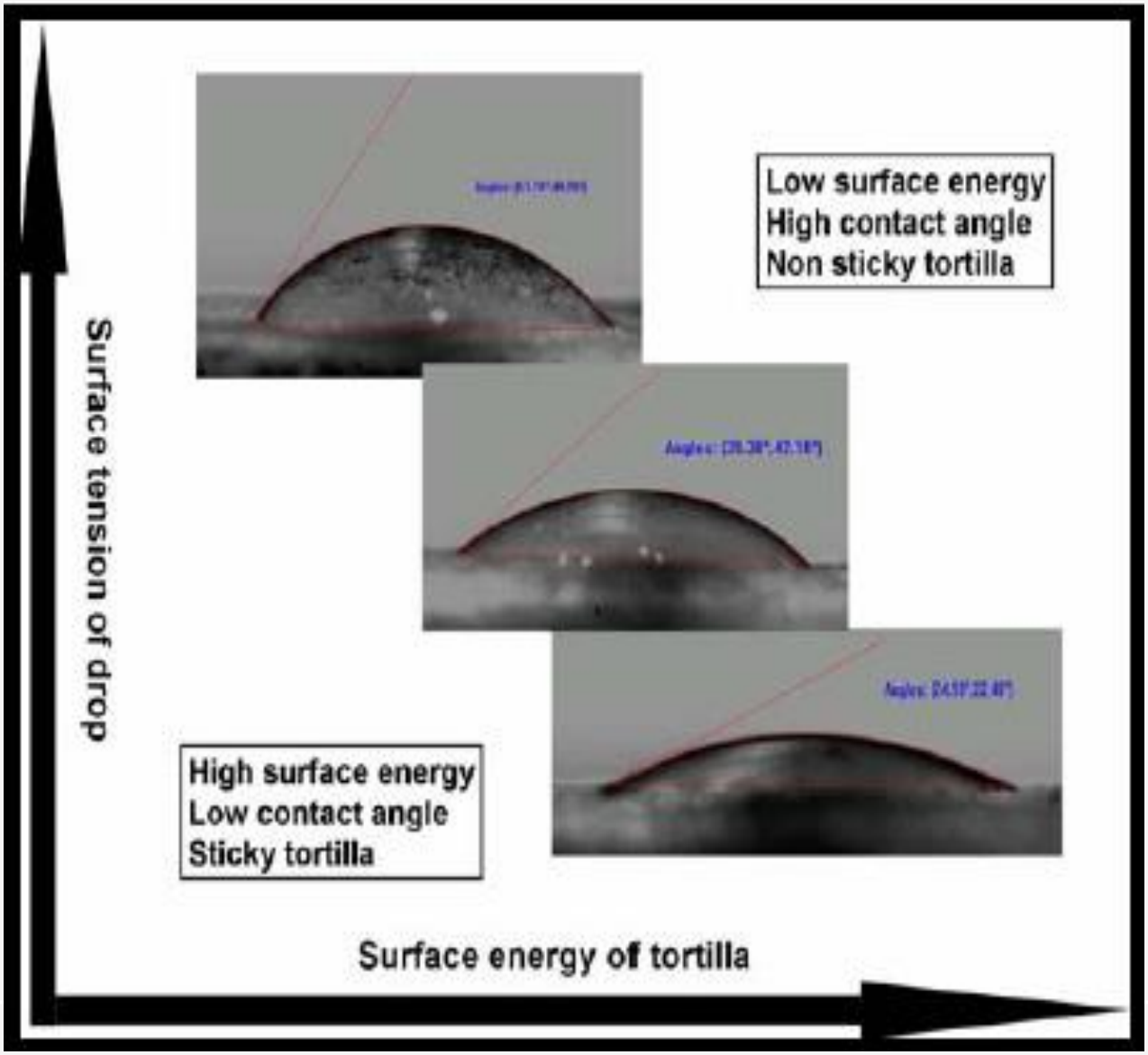
Contact angles comparison between tortillas Made with BFP 800, T-180 and Pationic 919





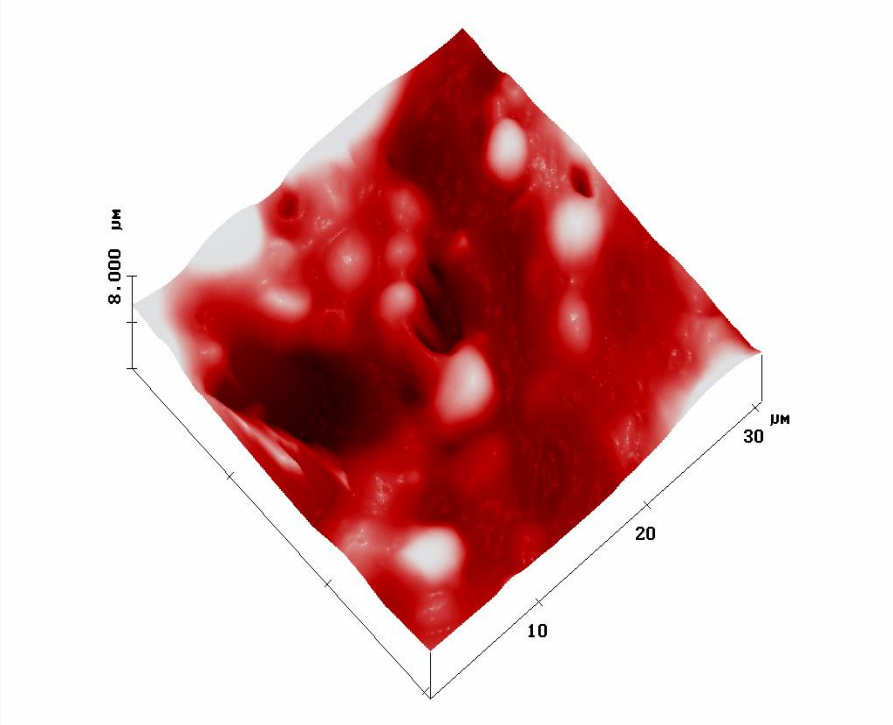


Relationship between Surface Energy and Tortilla Stickiness

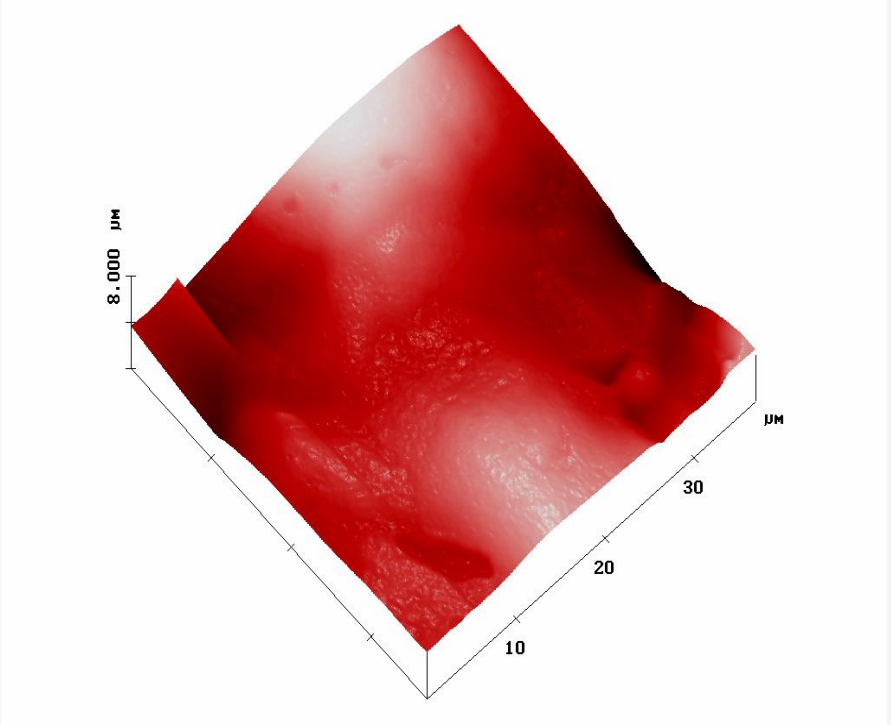


Atomic Force Microscopy – Surface Roughness

No Add Control Tortilla



T180 Test Tortilla

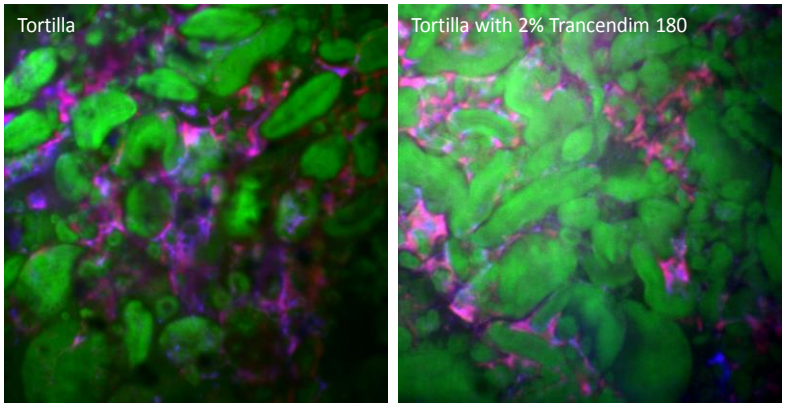


Nano-scale Analysis: The smooth the surface the less sticky

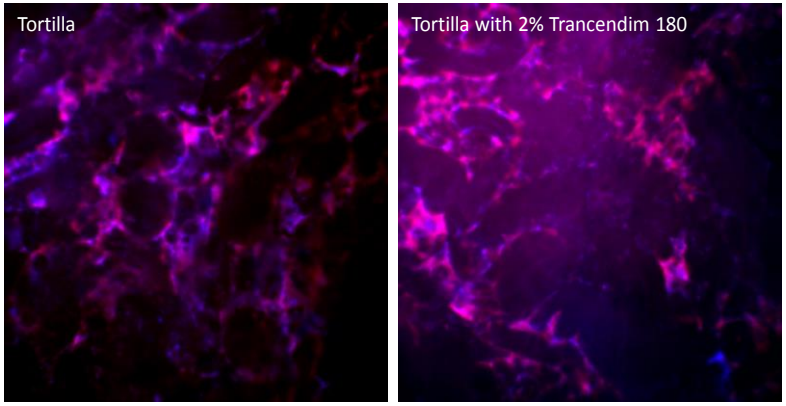
Confocal **L**aser **S**canning **M**icroscope of Tortilla

(# of contact points)

Overlayers of green, red and blue



Overlayers of red and blue colors



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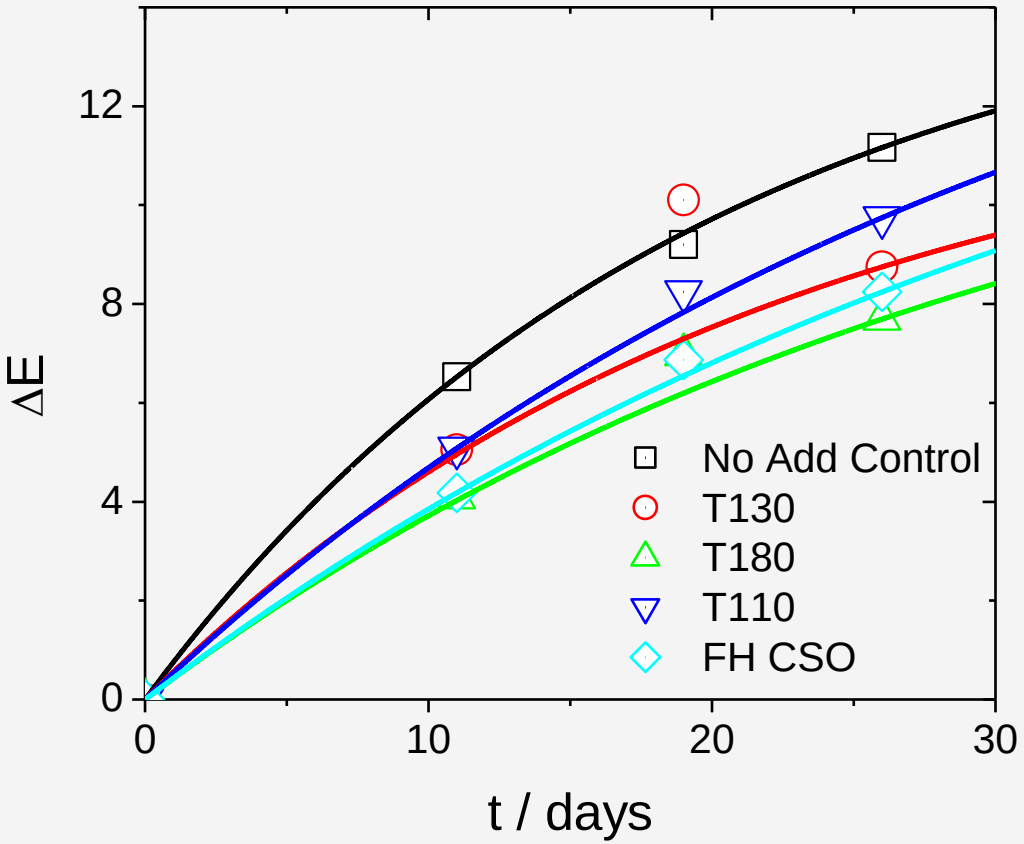
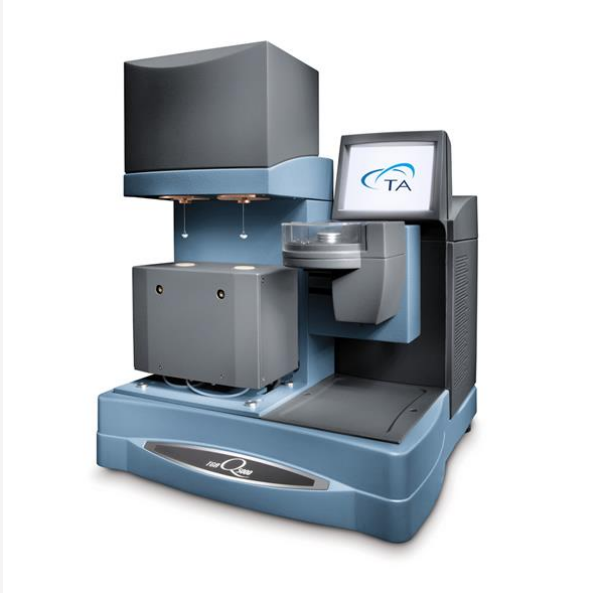
Moisture Migration Data Analysis



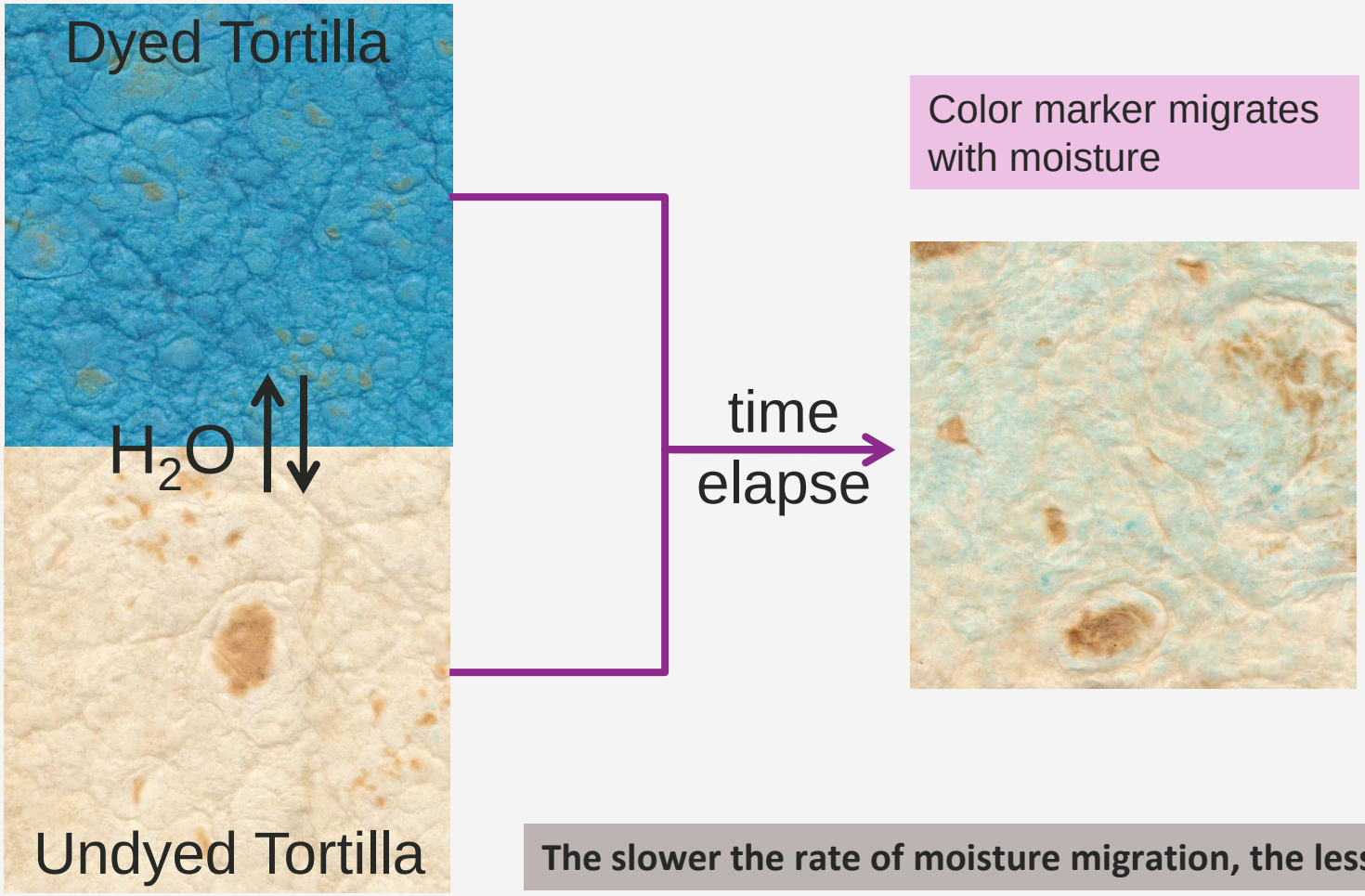
$$\Delta E = \Delta E_{\infty}\left(1 - e^{-kt}\right)$$



Dynamic Vapor Sorption Analyzer

- Directly measure moisture transfer rate from tortilla surface

Moisture Migration "Blue Tortilla" Study

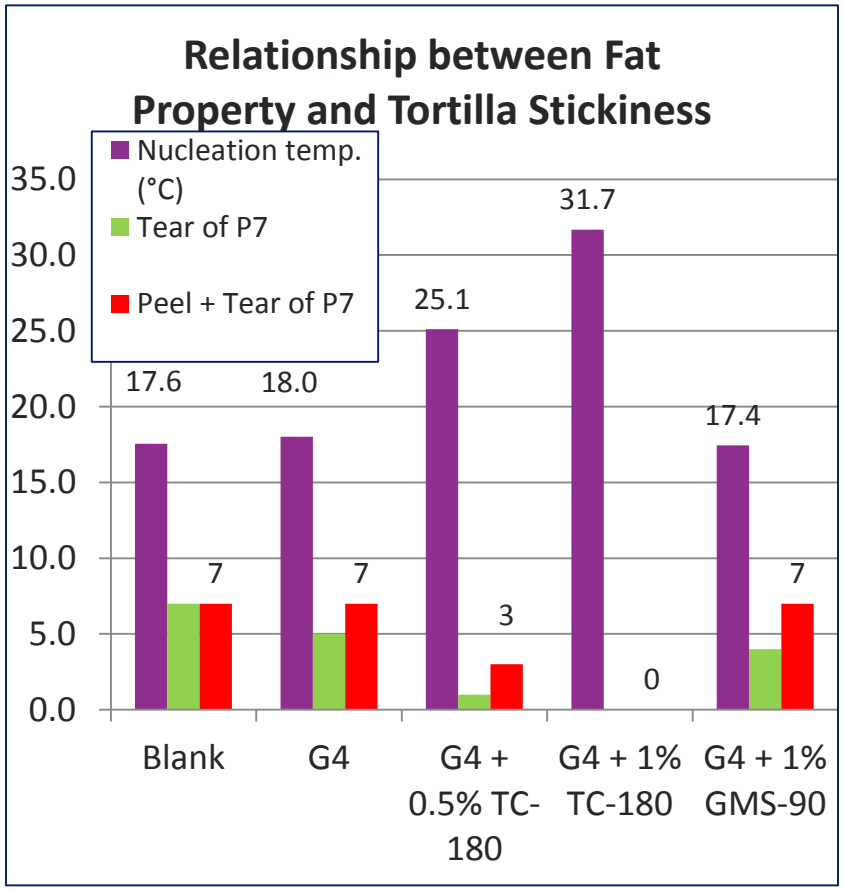


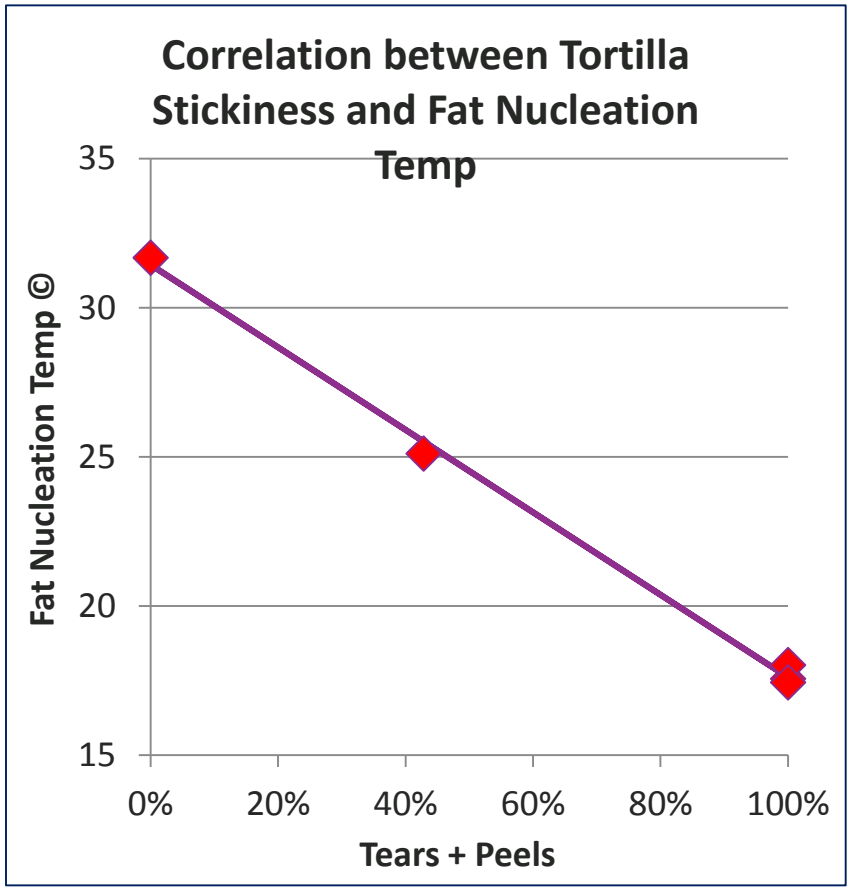
Color marker migrates with moisture

The slower the rate of moisture migration, the less sticky

Correlation between Tortilla Stickiness and Fat Nucleation Temperature

(Differential Scanning Calorimetry)





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Corbion Bucket Test – Case Study

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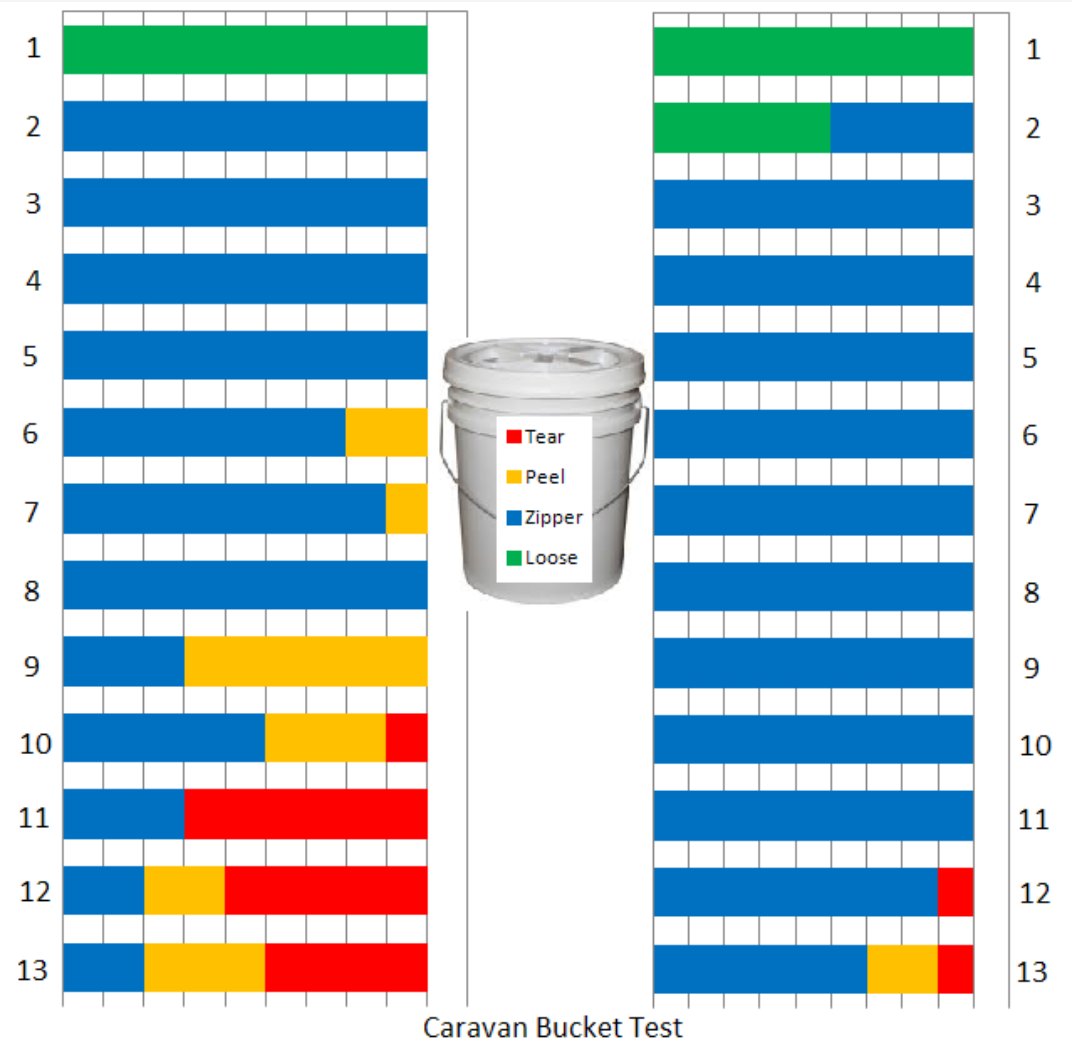
Corbion Tortilla "Bucket Test"



One of the tools Caravan utilizes to evaluate the effectiveness of tortilla anti-stick is a "Bucket Test."

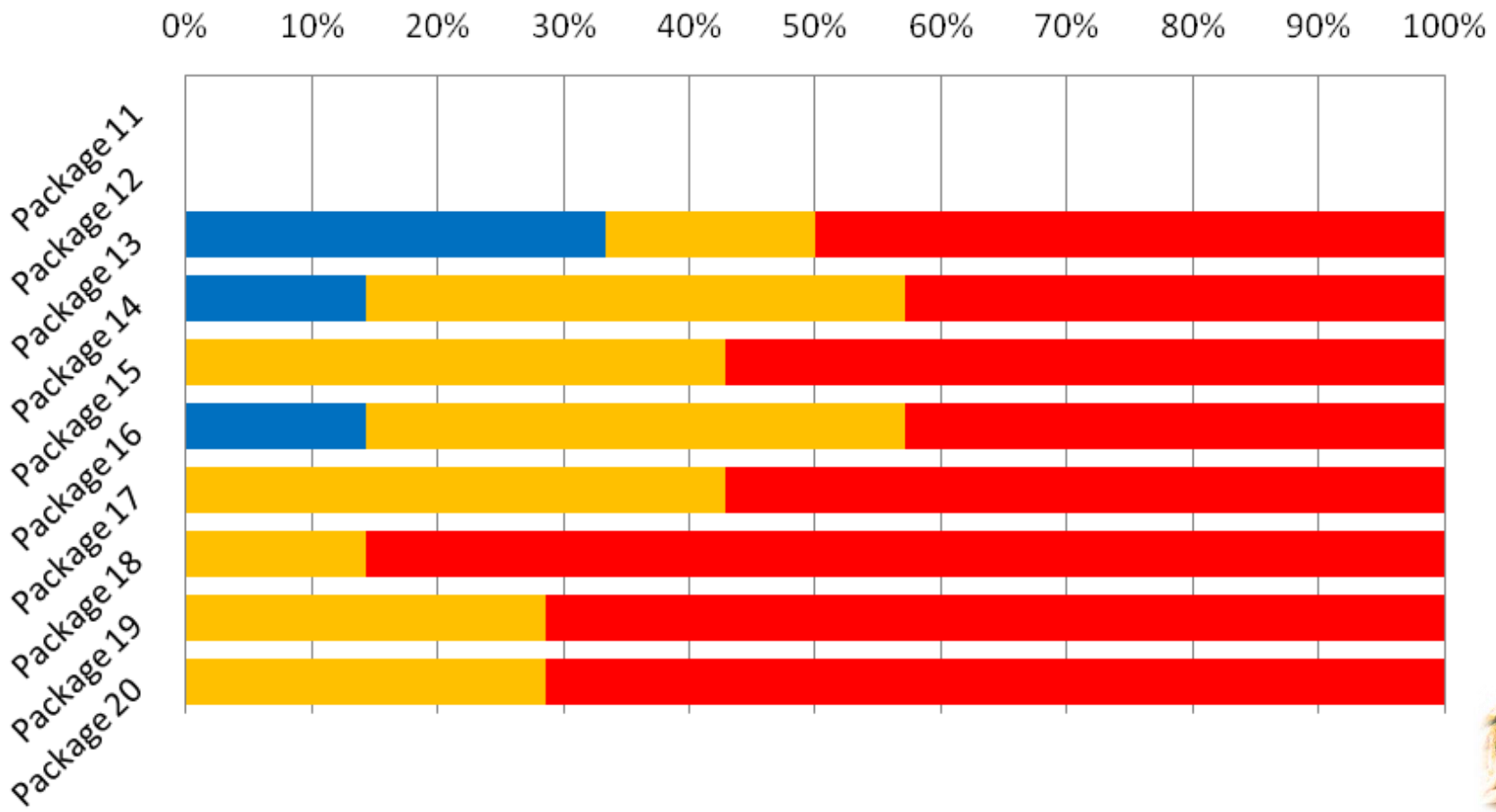
This test involves the storage of tortilla packages in deep stacks and then evaluating them from the top down, recording differences in sticking.

Grades are based on:

- "Loose tortillas"
- Tortillas that make a "zippering sound" when separated, but no damage occurs.
- Tortillas that suffer from surface "peels."
- Tortillas that "tear" and are considered unusable.

As can be seen, Tortilla Suave's superior emulsifier system far extends the pressure tortillas can withstand before suffering from costly sticking.

Tortilla Anti-Stick Study: Control / No Add



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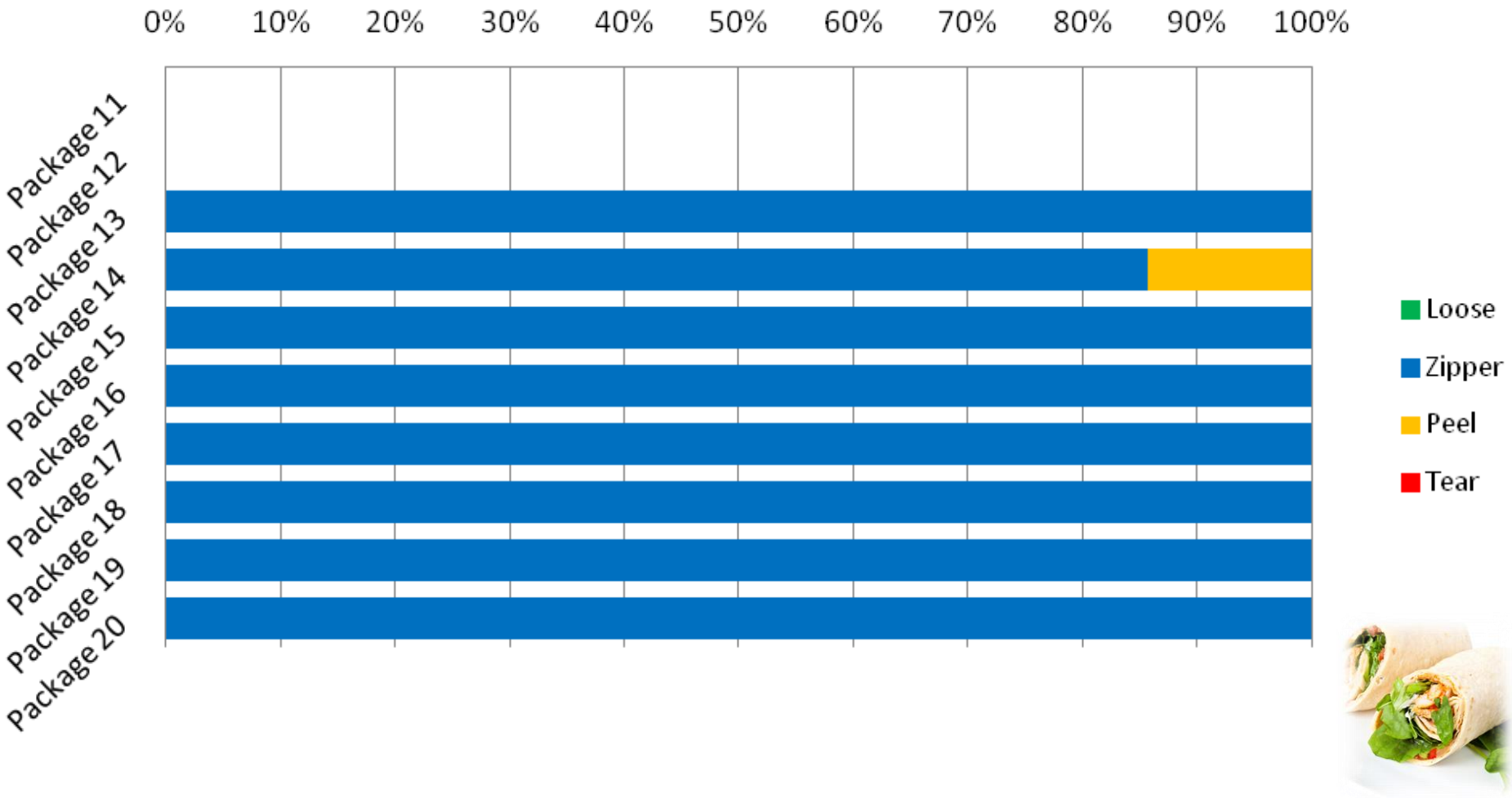
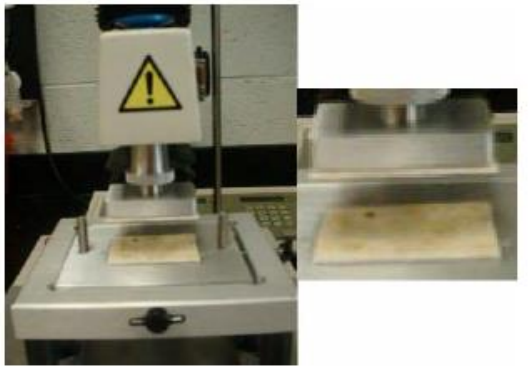
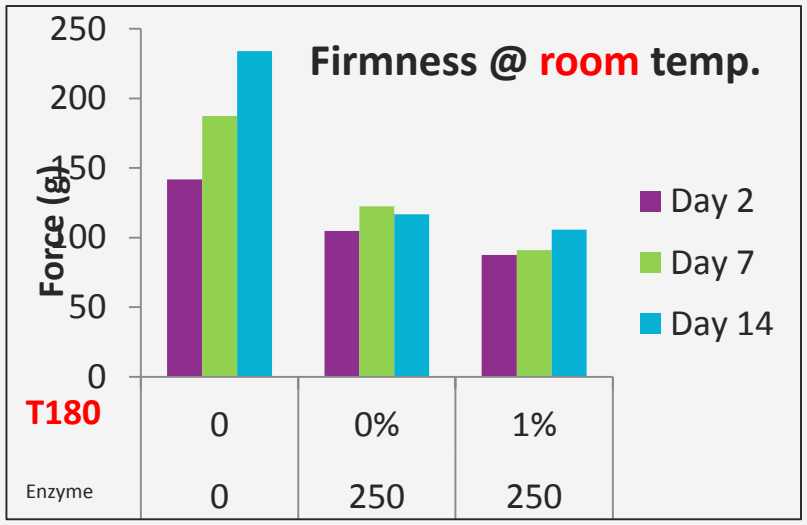
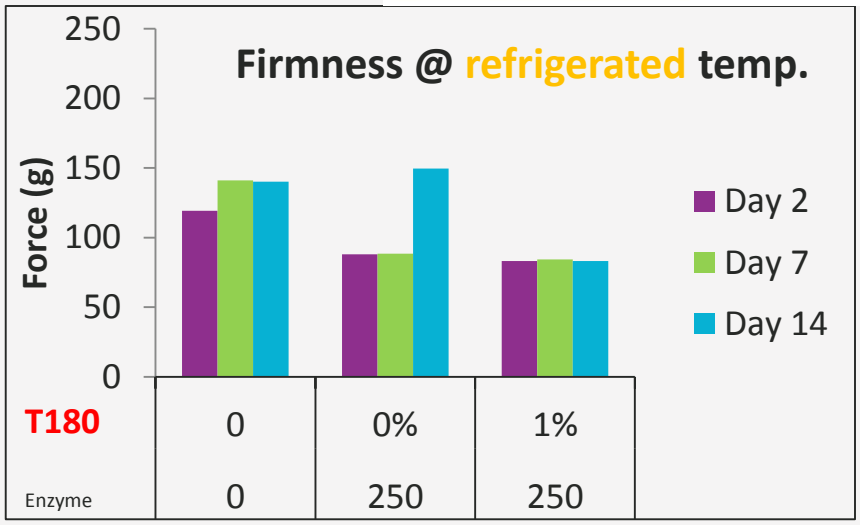
Tortilla Anti-Stick Study: 0.75% T180 (New PSD)

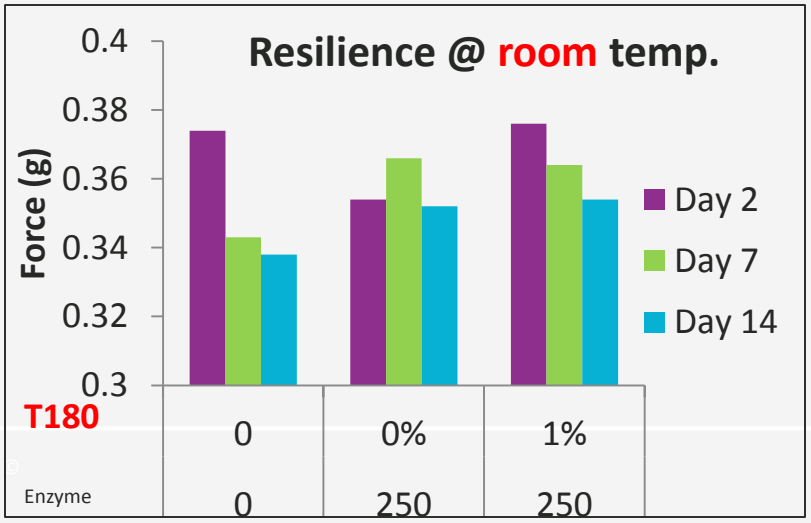


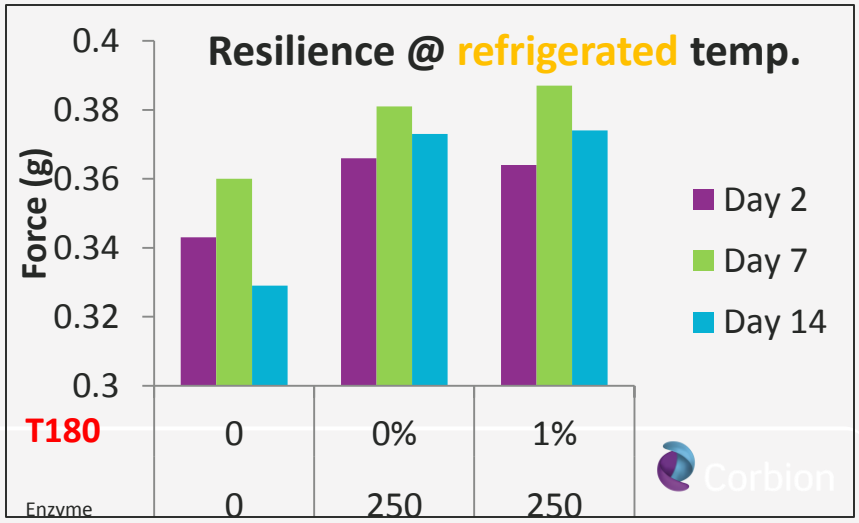
Effect of T-180 on Tortilla Texture











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Summary

1. Trancendim is able to reduce the surface energy, which could help to reduce moisture migration and then tortilla surface stickiness
2. The usage level and fat structure would have influence on tortilla stickiness. The unique property of Trancendim showed significant anti-sticking property.
3. Trancendim 180 also showed ability to maintain tortilla softness during the shelf life, especially at refrigeration condition.

Tortilla Blends from Corbion

Corbion is your expert, go-to partner for high-quality tortillas and flatbreads. Our team goes the extra mile to help you improve processes, products and profitability.

Whether you're looking for tastier, fresher, cleaner or simpler – Corbion has a solution you can trust.

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Current Anti-Stick Ingredients

Trancendim Product Line

- **Beaded Hi Diglyceride**
- **MP: 55-70°C (131-158°F)****
- **Very Low/No Trans (IV ≈ 3)**
- **Fat Structuring**

Trancendim 110 130 & 180
Trancendim Non-GMO

Current Anti-Stick Blends

- Value Added Blends:
  - Scaling, Handling, Increased Functionality,…
- Tortilla Stick No Mas
- Tortilla Stick No Mas Non-GM
- Tortilla Suave = Anti-Stick + Softeners

Tortilla Stick No Mas 2.0

- Item # 139059
- 1 – 2% usage
- Palm Oil, Corn Starch, Mono- and Diglycerides, Guar Gum and 2% or Less of Each of the Following: Soybean Oil, Silicon Dioxide (Flow Aid).

- Add on to ANY existing tortilla formula.

Tortilla Suave

- **Item #s 135093 & 136477 (GR)**
- **1 – 2% usage**
- Mono- and Diglycerides, Corn Starch, Wheat Flour, Guar Gum and 2% or Less of Each of the Following: Soybean Oil, Silicon Dioxide (Flow Aid), Enzyme (Wheat), Salt.
- **Superior ANTI-STICK & SOFTNESS**
- **Add on to ANY existing tortilla formula.**

Tortilla Solutions

Category	Product	SKU	Benefits	Usage
Anti-stick	Trancendim 180	134495	Specialty diglyceride that provides superior anti-stick properties in tortillas to minimize waste.	Variable
Batch Packs & Blends	Flexi Tortilla 2.0	138925	Provides maximum protection against sticking and tearing.	14.00%
	Strong Flow Tortilla 2.0	139026	Paste format. Provides maximum protection against sticking & tearing. Excellent roll-ability.	16.00%
	Tortilla Blanca 2.0	139057	Designed to create fluffy white tortillas, with great flexibility & softness	7.50%
	Tortilla Stick No Mas 2.0	139059	Provides excellent anti-stick properties for soft flexible tortillas. Non-GMO version available	1.0-2.0%
	Trim Carb Tortilla Ext 2.0	139082	Top seller! Easy to use mix for deliciously soft tortillas. Best when used with whole wheat flour.	80lbs/20 lbs flour
	Viva Tortilla Base	139096	Produces high quality, flour tortillas with great taste and flexibility. Includes whey for unique flavor.	8.00%
Clean Label	Pristine Tortilla Base	134273	Clean label tortilla base that produces soft, flexible, white tortillas.	8.00%
	Southern Tortilla 200 CL	138922	Clean label tortilla base that produces soft, flexible, opaque tortillas. Contains best-in-class anti-stick & freshness ingredient technology, allowing for reduced waste – in both manufacturing and in consumers' homes.	8.00%
Conditioning	Basic Tortilla 3 2.0	138624	A concentrated blend that provides excellent softness. Can add baking powder separately	3.00%
	Starplex 590 HS	139807	Improves overall quality of flexibility & softness.	Variable
	Tortilla Suave GR	136477	A balanced blend of ESL technology and anti-stick ingredients. It can be added on top of existing tortilla formulas to reduce sticking, improve softness, and increase rollability.	1.20%

Tortilla Solutions

Category	Product	SKU	Benefits	Usage
Flavor Blend	Meister Line	Various	Comprised of easy-to-use dry blends of herbs and spices, vegetables and specially milled grains, Meister products can be incorporated into your current formulations for breads, rolls, bagels and tortillas to appeal to today's adventurous consumers.	Variable
	Six Grain Plus	129044	A blend of six hearty whole grains that can be used to create whole grain tortillas, without bitter afternotes normally associated with whole grain breads.	10-25%
	Tomato Tortilla	133755	Tomato Tortilla is a blend of sundried California tomatoes, basil, garlic, onions and spices. This combination of ingredients produces savory, delicious, full flavored tortillas and flatbreads.	1.00%
Freshness Enhancers	Ultra Fresh Premium 1650	136223	Extends freshness & shelf life of tortillas & flatbreads. Can be added on top of existing formulas without making other ingredients adjustments. Gluten Free Version available.	.03-.125%
	Ultra Fresh Premium 225	136217	Extends freshness & shelf life of tortillas & flatbreads. Can be added on top of existing formulas without making other ingredients adjustments.	0.25%
	Verdad F95	2456100	A natural ferment that functions as a clean label mold inhibitor in bread, buns and flat breads. Can replace calcium propionate in products requiring 7-10 days of shelf life.	0.90%
	Verdad MP 100	140580	A truly natural, fermented solution that functions as a clean label mold inhibitor. Perfect for commercial package breads and an excellent replacement for calcium propionate in products requiring 10-20 days of shelf life.	2.50%

Most Recent Anti-stick Technology

(patent pending)

"Magic Dust" – Wheat flour and emulsifiers

- Apply outside dough balls or discs (fresh or frozen) at dough manufacturing facility as a flour dust
- Replace PAN spray at end user's (restaurants or at home)
- Crust color and texture improvement


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