THE EXPERT IN OILS AND FATS FOR TORTILLAS

Chris van Rooijen | October 2019

Let's create together

EUROPE TECHNICAL CONFERENCE

TORTILLA INDUSTRY ASSOCIATION TIA

BUNGE Loders Croklaan

AGENDA

1. Introducing Bunge Loders Croklaan
2. Oils and Fats
3. Oil Chemistry
4. Stability
5. Contaminants
6. Role of fats in Tortillas

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BRINGING TOGETHER EXPERTISE

The Bunge Loders Croklaan BTB companies in EMEA originate from:

BUNGE	WALTER RAU NEUSSER ÖL UND FETT AG	LINDEMANN	KRUSZWICA	Loders Croklaan
Culinary oils, Bakery fats and oils	Culinary oils	Artisanal Bakery fats and oils	Artisanal Bakery fats and oils	Infant Nutrition, Confectionery, Industrial Bakery fats and oils

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COMBINE & ENHANCE KEY BUSINESS ASPECTS

Enhanced Portfolio of vegetable oils

Extensive foot print of assets and innovation hubs

RAPESEED/ CANOLA

COCONUT

LECITHIN

SUNFLOWER

PALM

OLIVE

SHEA

SOYBEAN

Comprehensive product portfolios across key categories

A strengthened approach to sustainability

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PORTFOLIO OF OILS AND FATS

High-Stability Oils to extend fry life and shelf life

Pan sprays to improve pan release in bakeries

Non-Tempering Confectionery Fats to create production efficiencies, save production time

Non-GMO to meet natural channel needs

Organic to meet natural channel needs

Traceability
Centerfield traceability to region and farmers

SunButter
Clean label fat solution for confectionery

Structured MCTS
to improve muscle recovery medical/sports

Reduced Sat Fat
to meet health and wellness needs

Organic to meet natural channel needs

OPO
to meet natural channel needs

Algae Butter
to improve sensory experience across

High-Performance Shortenings
to improve bakery mouthfeel & shelf life

Flavored Oils
to conveniently deliver flavor in cooking

Shea Butter CBE
to enhance mouthfeel with steep melt

BungeMaxx Lecithins are missing in this overview!

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WE HAVE A **LONG HISTORY** OF DELIVERING **BREAK THROUGH INNOVATIONS** TO THE INDUSTRY

PAST

- Inventors of enzymatic rearrangement
- Inventors of cocoa butter equivalents
- Leading trans vet removal

PRESENT

- Contaminant mitigation (3MCPD and GE)
- Temperature-tolerant chocolate/hazelnut spread fat (Creamelt® Stand)
- Non-hydrogenated, non-lauric Coating Fats (Couva® 855NH/E)
- Low Saturated Premium Filling Fats (Creamelt® 600LS)
- Palm Alternative Filling Fats based on shea and coconut (Biscuitine® 270)
- Palm Alternative Bloom-retardant Filling Fat (Prestine® 17F)

FUTURE

- 3D printing: fat structuring for novel multi-layer products
- Multi-functional fat systems: clean label (e.g. in-situ STE)
- Liking: trigger brain response with healthy fat systems
- Patent on processing replacing tropical fats with HSHO SFO

INTELLECTUAL PROPERTY

- 52 patents filed in last 10 years of which 27 (52%) in last 3 years
- Key topics: infant, low safa, contaminant mitigation, self-emulsifying

WE HAVE **CREATIVE HUBS** IN EACH REGION.

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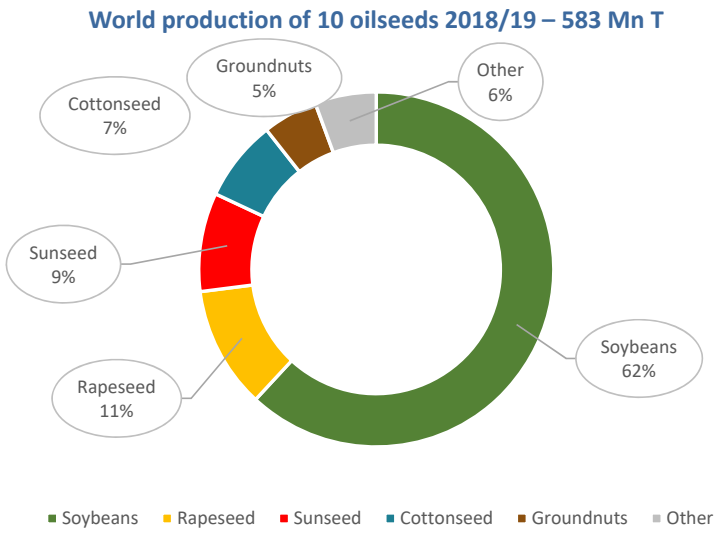
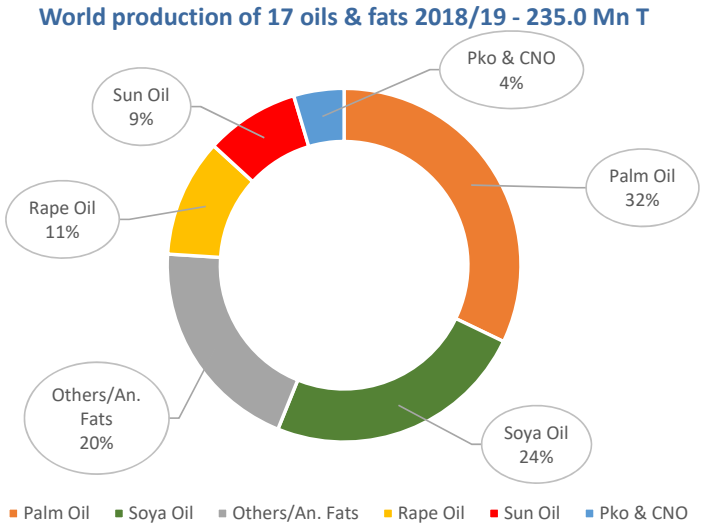
THREE MAIN GROUPS OF VEGETABLE OILS

Tropical Oils	**Liquid Oils**	**Other Tropical oils**
Palm	Soy	Shea
Palm Kernel	Rapeseed	Illipe
Coconut	Sunflower	Sal
	Cottonseed	Mango
	Groundnut	Kokum
	Corn	

WORLD WIDE PRODUCTION OF OILS AND FATS





Source: Oil World, Mielke

PALM OIL

Area : Malaysia, Indonesia, West Africa, South America

Harvest: All year round crop, Peak Aug, Sep, Oct.

Average yield: 3.5 MT per Hectare per year in the industry

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SOY BEAN OIL

Area:	North America, Brazil, Argentina, China
Season:	March/April through September/October
Average yield:	0.5 MT per hectare per year

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SUNFLOWER OIL

Area:	Argentina, EU, Russia, Ukraine, United States
Season:	September through Oct
Average yield:	0.7 MT per Hectare per year

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CANOLA OIL (RAPESEED)

Area:	China, EU, Canada (GMO), India
Season:	August through October
Average yield:	0.8 MT per hectare per year

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COTTONSEED OIL

Area:	China, USA, India, Pakistan, Africa
Season:	September through October
Average yield:	0.2 MT per hectare per year

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GROUNDNUT OIL

Area:	China, India, Africa, USA, Argentina
Season:	Mar-May / Jul-Aug
Average yield:	0.2 MT per hectare per year

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PALM KERNEL OIL

Area:	Malaysia, Indonesia, West Africa, S-America
Harvest:	All year round with peak August - October
Average yield:	0.4 MT per hectare per year

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COCONUT OIL

Area:	Philippines, Indonesia, Pacific
Season:	July through September
Average yield:	0.3 MT per hectare per year

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SHEA OIL

Shea currently much wanted, sustainably sourced origin.
The supply however is limited

Area	: West Africa
Harvest	: September through October
Average yield	: wild crop, cannot be calculated

OTHER TROPICALS

Sal nuts
(Sal)

Illipe nut
(Il)

Very limited supply !

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OTHER TROPICALS

Mango (kernel)

Kokum (kernel)

Not in Bunge portfolio!

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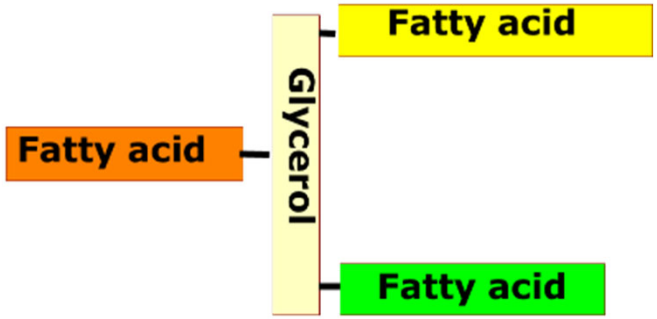
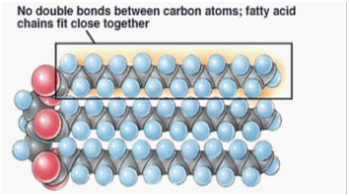
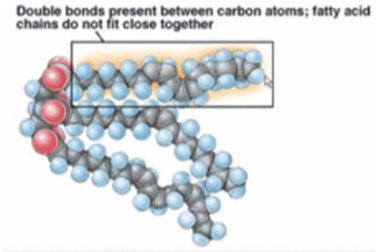
OIL CHEMISTRY



Structure of fat





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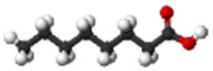
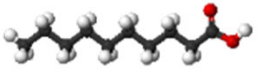
OIL CHEMISTRY

- There are three main types of fatty acids

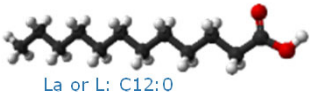
Saturated fatty acids



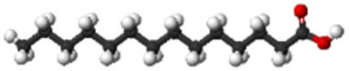
Cy: C8:0
mp: 17 °C



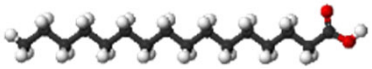
C: C10:0
mp: 32 °C



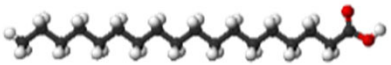
La or L: C12:0
mp: 43°C



M or My: C14:0
mp: 54°C

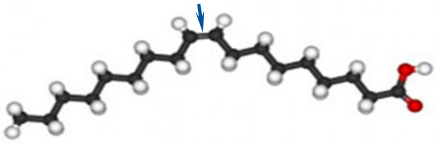


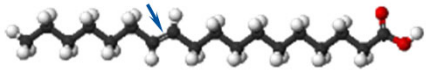
P: C16:0
mp: 62°C



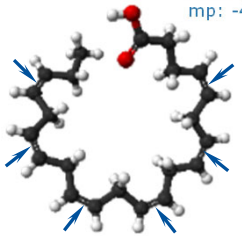
St or S: C18:0
mp: 70°C

Mono unsaturated fatty acids

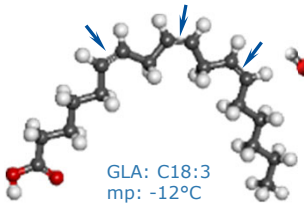




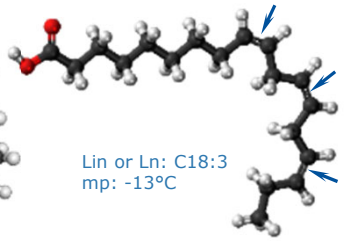
V: C18:1, 11t
mp: 45°C



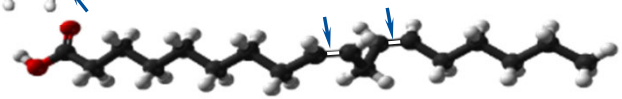
DHA: C22:6
mp: -44°C



GLA: C18:3
mp: -12°C



Lin or Ln: C18:3
mp: -13°C



Ln or L: C18:2
mp: -7°C

Poly unsaturated fatty acids

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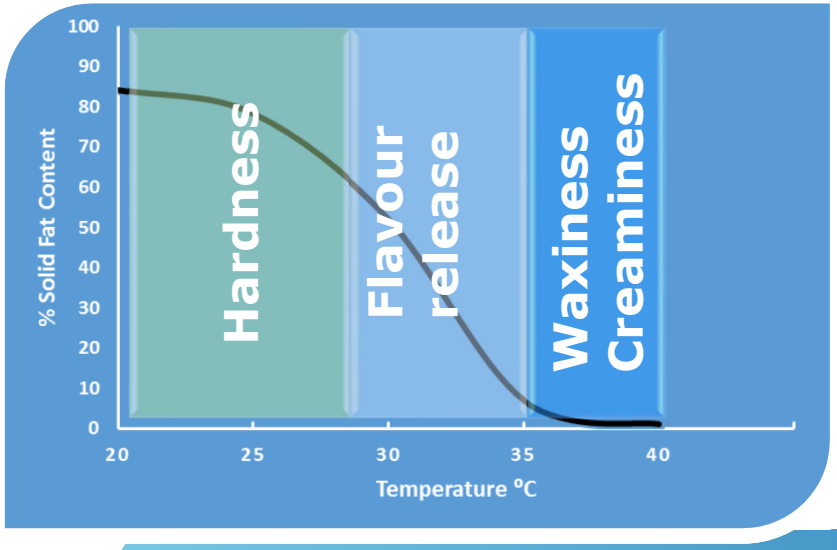
MELTING POINT OR MELTING PROFILE

- Fat is a mixture of triglycerides with different melting points.
- Consequently, fats do not have a sharp melting point but rather a melting profile.



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STABILITY

- Influences on product quality
  - Hydrolysis
  - Oxidation

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STABILITY

- Hydrolysis

Fat + Water ⟶ Free fatty acids and glycerol

Lowest level of FFA which can be tasted:

Butyric acid	(C4)	0.00006%
Caproic acid	(C6)	0.00025%
Caprylic acid	(C8)	0.035%
Capric acid	(C10)	0.02%
Lauric acid	(C12)	0.07%
Myristic acid	(C14)	0.5%
Palmitic acid	(C16)	1%

STABILITY

- Factors that influence hydrolysis
    - Lipase
    - Temperature (higher temp, quicker process)
    - Moisture (usually in com with micro-organism)
    - Soap

STABILITY

- Oxidation

  Auto – oxidation is a free radical mechanism

- Initiation

  Catalyst

  RH + O2 → R• + •OOH

  Unsaturated lipid — Free radicals

- Propagation

  R• + O2 → ROO•

  ROO• + RH → ROOH + R•

  Hydro peroxide

- Termination

  R• + R• → R-R

  ROO• + R• → ROOR

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STABILITY

- Factors influencing oxidation
  - Oxygen (air)
  - Degree of unsaturation of fat
  - Elevated temperatures
  - Certain Metals (e.g. copper, iron)
  - Light
  - Hydro peroxides

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CONTAMINANTS

- 3 MCPD
  - Suspected carcinogenic in humans
- Formation
  - Chloride reaction with glycerol

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CONTAMINANTS

- Glycidyl Esters (GE)
  - Suspected genotoxic

- Formation
  - Chloride reaction with glycerol

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CONTAMINANTS

Risks for human health related to the presence of 3- and 2-monochloropropanediol (MCPD), and their fatty acid esters, and glycidyl fatty acid esters in food

MCPD, glycidol, glycidyl fatty acid esters, process contaminant, refined oil fat

First published in the EFSA Journal: 3 May 2016

Adopted: 3 March 2016

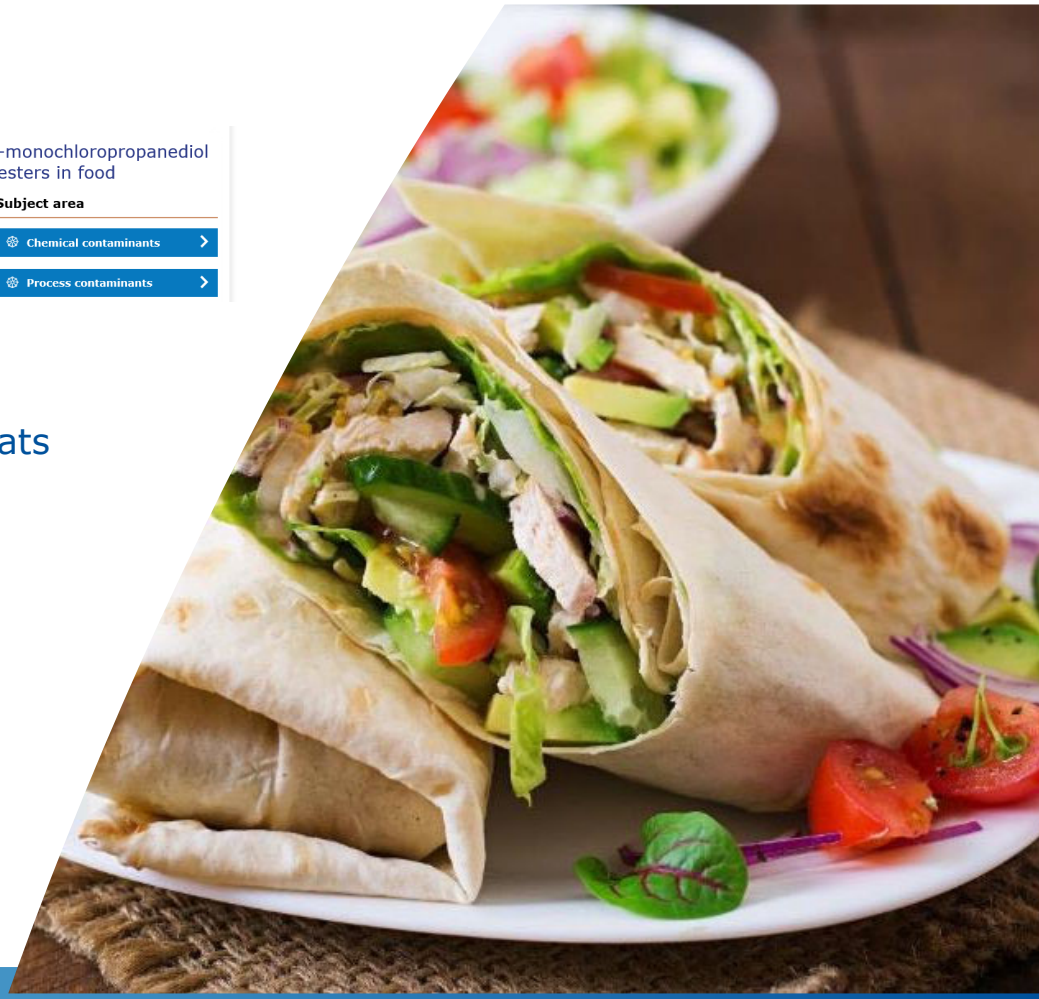
Corrected: 10 January 2018. This version replaces the previous one/s.

Subject area

- Chemical contaminants
- Process contaminants

Facts: Safety # 1 priority.

- 2002: legislation Australia and EU 20 ppm Soy saus
- 2008: start awareness/ discussion in EU all oils and fats
- 2012: - Adapted processing
  - New Deoderizer
- 2013: In house analysis equipment
- 2014: EFSA study, JECFA study
- 2015: New processing technology
- 2016: New in-house material treatment
- 2019: Nominated NENnovation Award
- 2021: EU legislation on oils and fats



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PURITY OF OILS

- Bunge Loders Croklaan offer
  - World wide complete portfolio
    - Guarantee 2 ppm 3 MCPD
    - Guarantee 1 ppm GE

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ROLE OF FAT IN TORTILLA

- Challenges faced Tortilla production
  - Dough development and handling
  - Sticking of the Tortilla in the packaging
  - Shelf Life
  - Flexibility/ plasticity after baking

- Solution in the fat choise
  - Enough solids to lubricate the gluten and allow extension
  - Enough solids to prevent sticking together in the packaging
  - Right balance of fatty acids
  - Right SFC value allowing enough flexability

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CUSTOMER WISHES TORTILLAS

- Flavor/ Taste
- Softness
- Color
- Toast points
- Strength/ Flexibility
- Non Stick in packaging
- Non Molding
- Safe

INGREDIENTS AND FORMULATION

- Weat Flour
- Water
- Salt
- Fat
- Leavening agent
- Mold inhibitors
- Dough and finished product conditioners
    - Reducing agents, Emulsifiers, Gums…
- Sugar, Enzymes

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WHEAT FLOUR

- Bread type flour
  - Hard wheat flours with moderate protein
  - Protein Typically 10.5 – 11.5%
  - Ash typically 0.45 – 0.52
  - Water absorption 60 - 64%

WATER

- Addition to dough between 45 -55%
- Functionality
  - → Hydration
  - → Gluten development
  - → Gelatenation
- Dough consistency
- Machinability
- Temperature control
- Critical in controlling Pillowing, Machine Sticking, Mold.

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SALT

- Usage 1.7 – 2%
- Functionality
  - → Flavor
  - → Interaction with Gluten (dough handling)
  - → Preservative

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FAT

- Choice of fat very important
- Nutritional value → SAFA/MUFA/PUFA
- Taste
- Dough handling → SFC/ Lubrication/ Gluten
- Stick during shelf life → Mono - Diglycerides
- Cracking → Solids
- Addition between 5 -15%
- Shelf life → Mono unsaturated fatty acids
- Emulsified shortening
- Enriched shortening with Enzymes
- Translucency (soft oil → more)

LEAVANING

- Possible leavening agents
    - Bio based
        - Yeast
        - Sour dough
- Mechanical (mixing intensity and moment of water addition)
- Steam
- Chemical leavening (most common) pH

SUGAR/ SWEETENERS

- Sucrose (granulated), Syrups, Dextrose.
- Not always used in Tortillas
- Function
    - Sweeting/ Flavor
    - Conservation/ Shelf life
    - Color on toast points

- Can increase risk of sticking tortilla in packaging

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MINOR COMPONENTS

<u>Dough conditioners</u>

- Reducing agents
  - Sulfites 0 – 45 ppm
  - L – Cysteine 0 – 75 ppm
  - Yeast (in active)
  - Protease
- Gums
  - Guar
  - CMC
  - Xanthan

MINOR COMPONENTS

- Emulsifiers

  Mono- and diglycerides
  - Improves crumb structure
  - Control hydration and water dispersion

  DATEM
  - Contains mono- and Diglycerides
  - Stiff doughs! Shrinkage

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TROUBLESHOOTING

- Major attention points
  - Mixing
  - Processing
  - Sticking

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MIXING UNDER DEVELOPED DOUGH

MIXING UNDER DEVELOPED DOUGH

OVER DEVELOPED DOUGH

COMPARISON MIXING

Over developed

Proper mixing

Under developed

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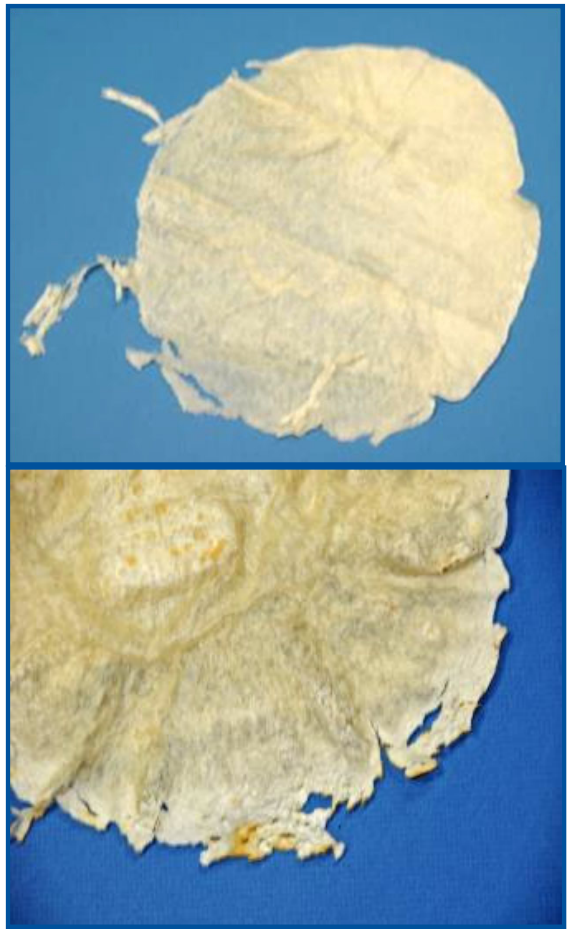
PRESS BLOWOUT

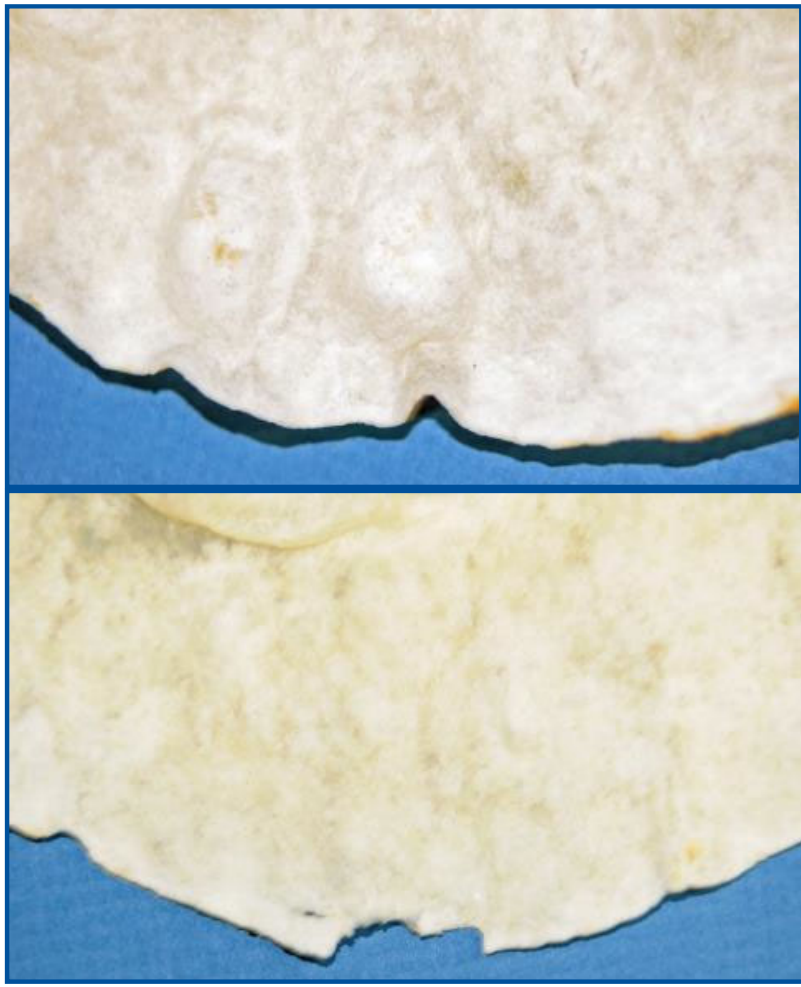
CAUSES OF PRESS BLOWOUT

- Press too hot
- Too long Dwell time
- Pressure too high
- Dough overdeveloped
- Dough underdeveloped



UNEVEN EDGES

- Dough underdeveloped
- Not enough hydration of the dough
- Dough dried out after mixing
- Dwell time too long
- Press temperature too hot
- Press pressure too high

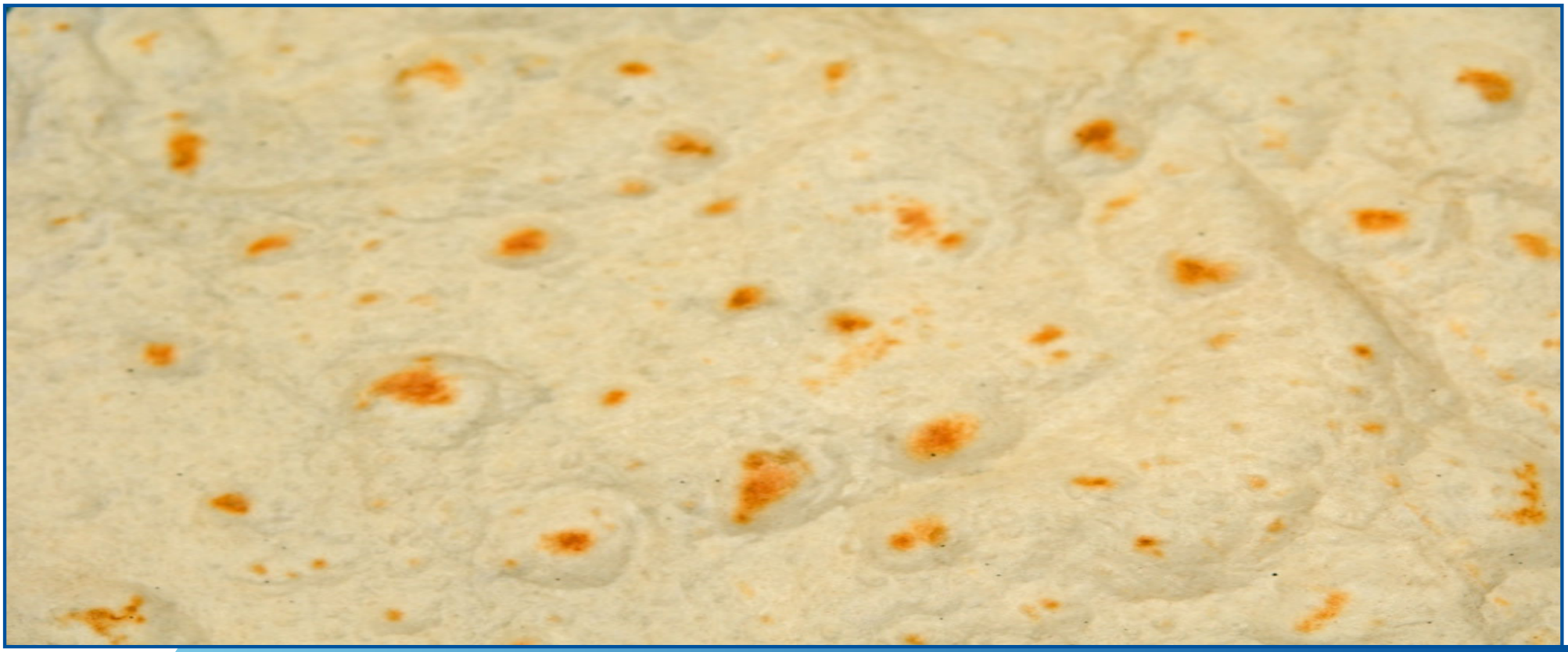


REASONS OF TRANSPARENCY

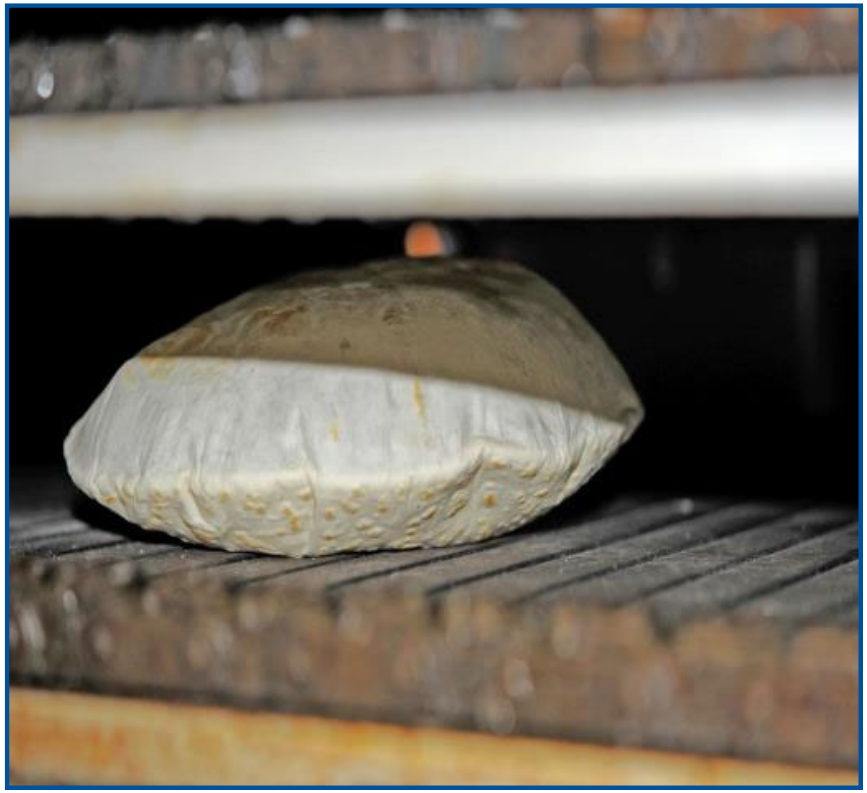
- Dough temperature too warm
- Dough over developed
- Dwell time too long
- Press temperature too high
- Pressure of press too high

- Recipe
  - Leavening
  - High amount of reducing agents
  - Fat % and choice

TOAST POINTS



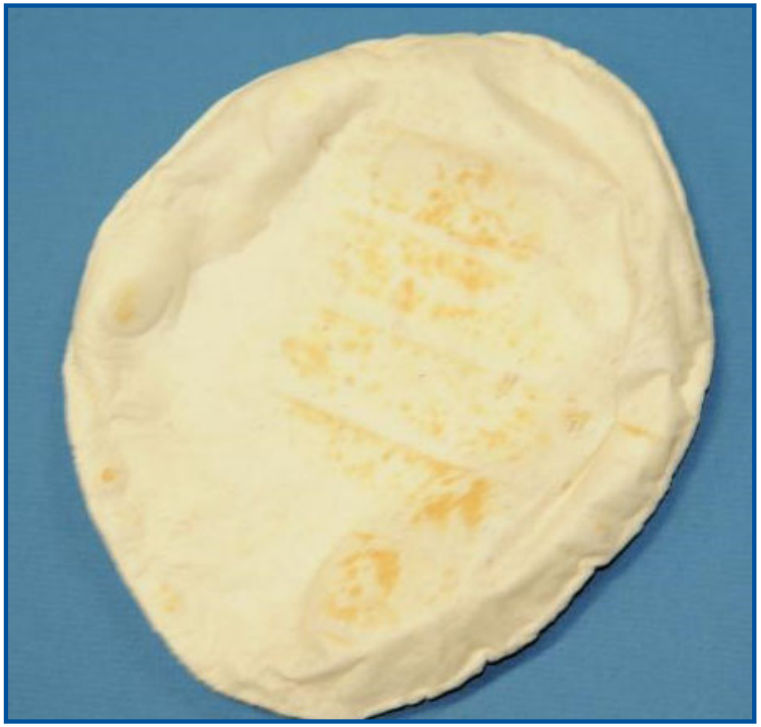
PILLOWING



PILLOWING

WHAT LEADS TO PILLOWING?

- Oven set up
- Baking temperature
- Amount of leavening



STICKING

- Sticking in two fold

1. The Tortilla sticking to the press during the press process
2. Two or more Tortilla’s that stick together and will not separate after being packaged for any period of time

MAIN REASONS STICKING PRESS

- Bottom plate has more heat than top plate
- One of the heating elements in the press is not working properly
- Over developed dough
- Over hydrated dough
- Recipe

MAIN REASONS STICKING IN PACKAGE

- Recipe
  - Reducing agents L – Cysteine or Sodium Metabisulfiet too high
  - Fats, Solids, Liquids, gluten lubrication
  - Sugar(s), Hydroscopic
  - Leavening system in relation to pillowing, result weak points.
  - Under baking
  - Baking profile

MAIN REASONS STICKING IN PACKAGE

- Cooling very important
  - Δ max 5 °C
  - Minimal/ no condensation in packaging
  - Warehouse temperature
  - Temperature shifts minimization
  - Compressing Tortillas (don’t stack to much)

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QUESTIONS?

ASK FOR MY CARD IF YOU NEED TAILORED ADVICE


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