

Selecting high quality flours for making tortillas

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Tortillas – A universal pleasure





As a result, the tortilla market is growing

- The numbers do not lie: the tortilla market is expected to increase at a high CAGR of 5.45%
- in the global market to account for the more significant market value of approximately \$55.5 billion
- in a forecast period from 2022to-2030 (Market Research Future [MRFR] 2022).

Sales of Baked Goods by Segment			
Current Year Growth			
Bread	2.7		
Tortilla	5.5		







Baking is a transformation process



Potential influence of raw material quality (flour)







CHALLENGE 1: Keep the consistency under control!

- WATER ABSORPTION is the main impacting factor of CONSISTENCY
- <u>Technical challenge:</u>
 - If there is not enough water, the dough is dry, hard and brittle;
 - If there is too much water, it becomes soft and sticky.
- This will impact the entire process and has a key role in obtaining a final product that meets quality standards.







How to measure the water absorption?



THE MIXOLAB 2 is the perfect tool to measure the Water absorption!!!





Other information available within the same test:

- Effect of mixing
 - Development time
 - Stability
- Protein denaturation due to temperature
- Starch gelatinization
- Amylase activity
- Starch retrogradation

CHALLENGE 2: avoid stickiness at all costs!





Solution: keep the protein/damaged starch balance under control

There is an **ideal level of damaged starch** according to the level of proteins Define the ideal area for accepting incoming flours





THE SDMATIC 2 ALLOWS FOR A SIMPLE, FAST, SAFE ANALYSIS OF STARCH DAMAGE

 Based on the measurement of iodine absorption, it works on 1 gram of flour and provides results in only 10 minutes.



- 1. Preparation of an iodine solution.
- 2. Iodine creates an electrical flow.
- 3. When the iodine fixes on the damaged starch, the intensity of the current decreases.
- 4. The less intense the electrical current, the higher the damaged starch content.

High DS content VS LOW DS content

SDmatic a

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CHALLENGE 3: Extensibility and Elasticity of the dough are critical

EXTENSIBILITY : CAPACITY OF THE DOUGH TO BE STRECHED WITHOUT BREAKING



ELASTICITY: TENDENCY OF THE DOUGH TO RETURN TO ITS INITIAL POSITION AFTER DEFORMATION



- <u>Technical challenges:</u>
 - A dough that is not extensible will not spread during shaping.
 - A dough that is too extensible will not hold shape well enough.

- <u>Technical challenges:</u>
 - If the elasticity is too low, the dough won't hold shape.
 - If it is too high, the dough will tend to retract, which impacts the size of the finished product.

Extensibility and elasticity mainly depend on the **quality of the protein network** They will have a **major impact** of the **SHAPE**, the **DIAMETER** and the **THICKNESS** of the final product.



STRONG impact on the dimensional characteristics

Whatever the type of tortilla, the dimensional characteristics (length, width, diameter, thickness...) must be impeccable!



 Manufacturers must respect the weight and number of tortillas in each package

Examples:

- <u>Thickness:</u> If thickness is not compliant, global weight may not be respected
- <u>Diameter:</u> If diameter is too big, the tortilla cannot enter the package...





How to keep the final shape as regular as posible?



PM

THE ALVEOLAB MEASURES THE CHARACTERISTICS OF THE DOUGH SUCH AS EXTENSIBILITY AND ELASTICITY



- P: Tenacity: Capacity to resist deformation
- L: Extensibility: Maximum volume of air the bubble can contain
- Ie.: Elasticity index: Resistance to deformation
 le = P200/P (P200: pressure at 4 cm from the beginning
 of the curve)
- W: Dough baking strength (area under the curve) or Energy value



CHALLENGE 4: A proper rollability / foldability is key to garantee the absence of deffects

ROLLABILITY / FOLDABILITY : CAPACITY OF THE TORTILLA TO BE ROLLED/FOLDED WITHOUT CRACKING OR BREAKING

→ Without proper foldability, the tortilla will be likely to crack easily.

The absence of defects in the finished products is key to satisfy consumers



Main impacting factors are :

- The protein content
- The protein quality
- The level of damaged starch
- Formulation (addition of emulsifiers, and enzymes)





CHALLENGE 5: The shelf life must be controled to garantee customer satisfaction

• SHELF LIFE: THE LENGTH OF TIME THAT THE TORTILLA IS CONSIDERED FRESH AND SAFE TO EAT

- Without talking about safety, there is a point when it is no longer possible to enjoy a tortilla.
- After baking, starch in the tortilla tends to recrystallize partially (starch retrogradation),
- This phenomenon has detrimental effect on the sensory and storage qualities
- The faster the retrogradation, the quicker the flour tortilla will lose its freshness.

Main impacting factors are :

- The starch characteristics (Starch damage, type of granules, amylose/amylopectin ratio...)
- The formulation (addition of emulsifiers, and enzymes)



Key quality parameters - Summary



A whole range of solutions is available to help you master your tortillas quality !

	NIR	SDmatic	Alveolab	Mixolab 2
Water absorption	(x)		Х	X
Stickiness	(x)	Х		
Dough consistency	(x)	(x)	Х	X
Extensibility			Х	
Elasticity			Х	
Foldability/Rollability	(x)		Х	Х
Pillowing	(x)		Х	Х
Color		Х		(x)
Shelf life		(x)		X

X : direct measurement. (X) : indirect measurement



















Case study: Selecting the best wheat for a tortilla application

Project done in collaboration with the CYMMIT, Harinera Anahuac and Tortillera la Carreta

Materials

15 wheat varieties have been selected :

		SKCS	Flour	Elour Protoin	
#	Variety	Hardness	Moisture	content	
π	variety	Index	content	content	
1	ALONDRA F2014	59,1	13,17	10,6	
2	BACOREHUIS F2015	61,5	13,33	12,1	
3	BORLAUG100 F2014	64,0	13,29	11,9	
4	CIANO M2018	68,7	12,83	12,0	
5	CISNE F2014	64,2	12,75	10,4	
6	CONATRIGO F2015	63,0	12,79	11,7	
7	FUERTEMAYO F2016	70,1	12,87	12,0	
8	HANS F2019	66,5	12,9	11,7	
9	KRONSTAD F2014	71,5	13,11	12,6	
10	LUMINARIA	65,5	12,9	12,3	
11	NORESTE F2018	66,2	13,14	12,6	
12	NORMAN	58,3	12,71	11,8	
13	TACUPETO F2001	62,6	12,84	11,5	
14	VALLES F2015	76,3	12,63	12,5	
15	VILLA JUAREZ	64,2	12,9	10,9	
	Minimum	58,3	12,6	10,4	
	Maximum	76,3	13,3	12,6	
	Average	65,4	12,9	11,8	



- All hard wheat varieties, with strong or medium strong gluten
- Grown under optimal conditions at the CIMMYT research station in the North of Mexico



Methods



Tortilla production test protocol (details)

A SIMPLE FORMULATION AND A STRAIGHTFORWARD TEST PROTOCOL

INGREDIENT	QUANTITY (g)
FLOUR	500
BAKING POWDER	20
SALT	10
SHORTENING	50
PRESERVATIVE	5
WATER	Varying based on WA-SRC



A COMPLETE TORTILLA ANALYSIS





FOLDABILITY (Score from 1 to 5)



OPACITY (%)



TOTAL SCORE (From 0 to 7)

Overview of the tortilla results









КРМ

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Tortilla Quality Parameters								
#	WEIGHT	DIAMETER	THICKNESS	OPACITY	ROLLABILIT	FOLDABILIT	TOTAL	
π	(g)	(cm)	(mm)	(%)	Y	Y	SCORE	CONCLUSION
1	45,4	21,7	1,4	95	5	1	2	BAD
2	43,7	23,9	1,5	85	5	4	7	GOOD
3	43,6	22,9	1,5	85	5	3	4	MEDIUM
4	42,1	25,2	1,6	50	5	3	5	MEDIUM
5	43,5	23,5	1,6	80	4	2	5	MEDIUM
6	43	23,6	1,5	80	4	4	6	MEDIUM
7	43,2	22,3	1,4	90	4	2	3	BAD
8	44	22,8	1,4	75	4	2	1	BAD
9	43,7	23,9	1,3	85	4	3	6	MEDIUM
10	43,9	22,4	1,5	85	3	3	2	BAD
11	45,8	22,6	1,7	80	4	2	4	MEDIUM
12	45,1	23,2	1,5	95	5	4	7	GOOD
13	45	22,9	1,6	95	4	5	6	GOOD
14	45,7	21,7	1,5	90	4	3	6	MEDIUM
15								
Min	42,1	21,7	1,3	50	3	1	1	
Max	45,8	25,2	1,7	95	5	5	7	

Damaged starch, the best indicator for overall quality of wheat for tortilla making



•UCD values > 22 predictive of poor quality tortillas

•UCD values < 19 predictive of high quality tortillas

The SDmatic allows the definition of simple specifications to select high quality wheat for making tortillas.

Alveograph: Results worth investigating further...



- Low quality wheat for making tortillas have a tendency to be associated with a higher tenacity (P value).
- No clear discrimination can be made besides this point about the overall quality of the tortillas (TOTAL SCORE).
- HOWEVER, the total score is a GLOBAL quality parameter, Let's see if it is possible to link the Alveograph with other parameters...



Looking into greater details, the Alveo allows to set up efficient specifications

TORTILLAS					
PARAMETERS	Р	L	P/L	W	le
DIAMETER (cm)	-0,31	0,66	-0,37	-0,21	-0,17
AREA (cm2)	-0,30	0,36	-0,36	-0,19	-0,15
THICKNESS (mm)	-0,11	-0,02	-0,07	-0,16	-0,13
OPACITY	0,06	0,10	0,05	0,04	-0,03
ROLLABILITY	-0,49	0,48	-0,55	-0,29	-0,02
FOLDABILITY	-0,29	0,49	-0,36	-0,14	-0,14
TOTAL SCORE	-0.45	0.61	-0.53	-0.29	-0.21



ΡΜ



 Setting a specification L > 100 mm allows to ensure the obtention of a diameter higher than 22,5 cm.



The Alveograph allows the definition of efficient specifications to guarantee a good diameter.

The Mixolab : a good indicator of the tortilla's rollability



Making it even more simple: The Profiler





In the end: Take informed decision based on a complete quality analysis



Index type	Values	Significance : the higher the index value the
ABSORPTION		more the flour absorbs water
MIXING		more the flour is stable at kneading
GLUTEN+	From 0 to 9	more the gluten resists heat
VISCOSITY		greater the dough's viscosity when heated
AMYLASE		weaker the amylase activity
RETROGRADATION		shorter the cooked product's shelf life will be



Finally, IN or OUT ?











Conclusion





Study conclusion and Acknowledgements



"Starch damage is the most important trait influencing the overall tortilla quality and should always be analyzed when producing flour for tortilla making" (Raul Vega – TIA presentation 2021)

> Raul Vega – Director of La Carreta

> > HARINERA



José Antonio Gressi Lopez – Op. director



ARRE

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CHOPIN Technologies is a brand of KPM Analytics





Automated Product Inspection using 3D Vision



Imaging and analysis solutions for food producers that ensure quality standards, reduce production costs, and increase productivity



- Avg Color of Top
- Avg Color of Bottom (toast/dark marks ignored)

Anomoly Detection

- Holes, Folds, Tears, Bites, Tails
- Irregular Edges, Foreign Objects
- Dark Spots & Burn Marks







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2D Geometry

Toast Marks

Total Number

- Min, Max, Avg Diameter
- Roundness/Shape Verification
- Area Measurements



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Let's go further – together!

Many applications can be considered:

- Quality follow-up of the raw materials (wheat flour, corn...)
- Making correlations with the final product

2,5

2,0

Couple (Nm) 1,0

0,5

- Analysis of frozen dough
- Analysis of enzymes and ingredients
- NPD and R&D : improve shelf-life, GF, clean label... Improve nutrition without affecting rheological properties
- Analysis of dough sampled from the production line

Do not hesitate to contact us for more information ! **K P M**







Thank you for your attention!

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