Unlocking dough dynamics: enzymes in action

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Senior Expert, Product Application

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Content

- Introduction to dsm-firmenich
- Enzyme working mechanism
- Benefits of enzymes in tortillas
- Wheat flour components
  - Controlling dough properties with hemicellulase
  - Improving size and shape with protease and glucose oxidase
  - Prolonging freshness with maltogenic amylase
- Enzyme toolbox for wheat tortillas

Three dynamic markets, two iconic names, one foundational purpose

We bring progress to life

We're a trusted partner to global companies operating in high-growth and resilient markets. We're innovators in **nutrition, health, and beauty**.

~30,000

passionate, talented, and diverse people in our global team

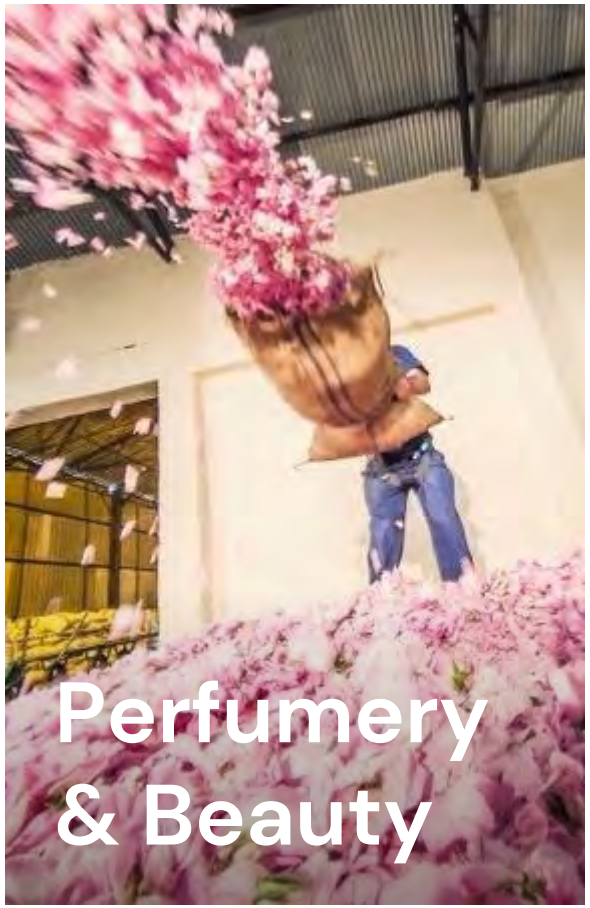
150+ years

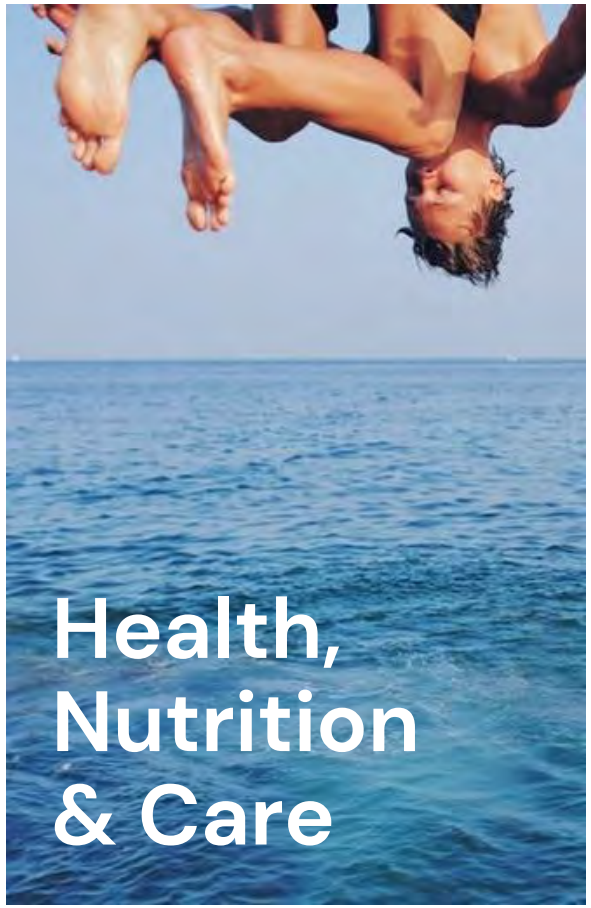
of combined scientific discovery and innovation heritage

€12+ bn

combined revenue

Innovators in nutrition, health and beauty





To be carved out in 2025

Taste, Texture & Health (TTH)

Imagine a world where you don't have to choose between what tastes good, what feels good, and what is good for the planet.

At dsm-firmenich we have the recipe to lead a new era in Taste, Texture and Health.

We bring progress to life by co-creating with our customers to transform how the world eats.

Healthier. More delicious. Better for people and planet.

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Our experts work with you to deliver sustainable baking solutions in taste, texture and health

Enzyme working mechanisms and functionality principles

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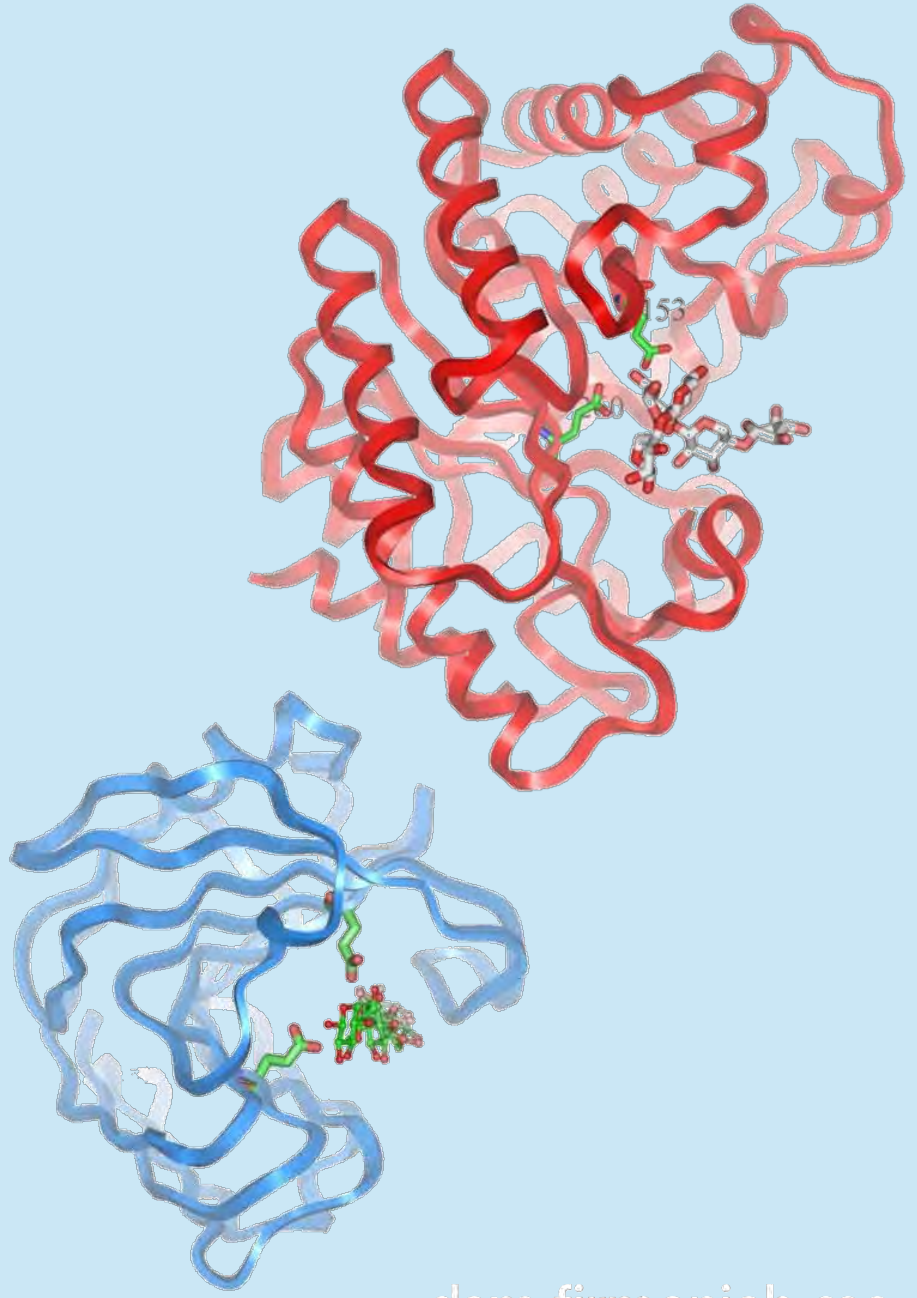
What are enzymes?

- Naturally occurring in nature and biodegradable
- Catalysts – making biological reactions happen faster
- Specific – enzymes make targeted molecular conversions in a predictable way with fewer side-reactions and by-products
- Enzymes are considered processing aids in baked products and therefore require no labelling

Bacteria

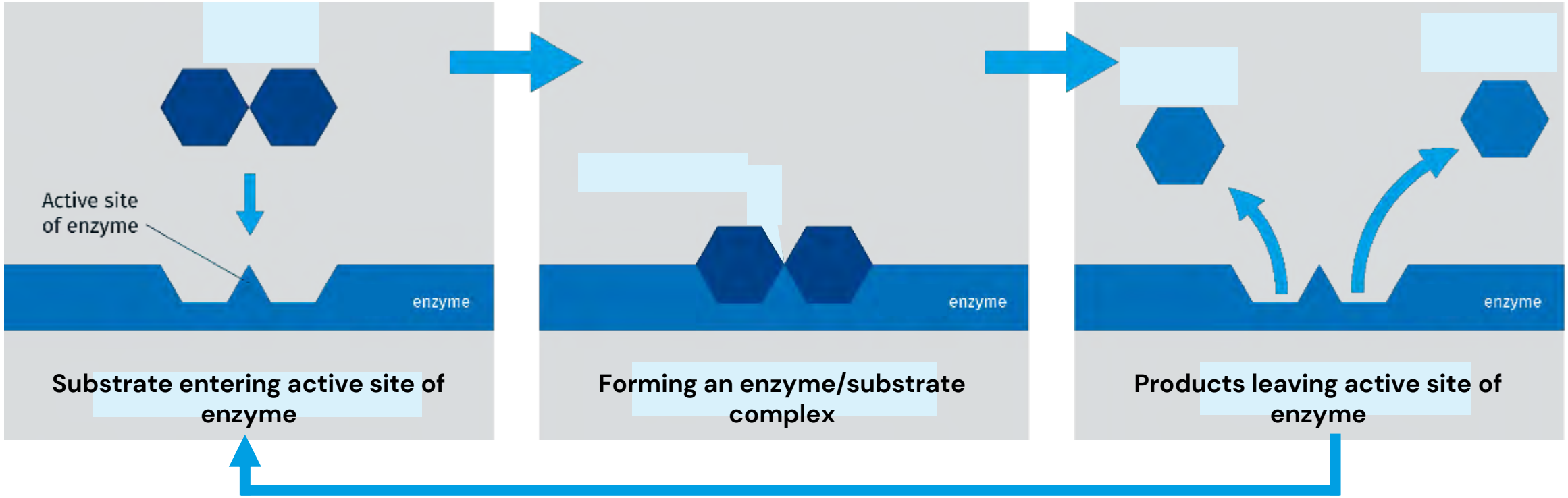
Fungi

Yeasts



How an enzyme works

Key-lock principle



Substrate entering active site of enzyme

Forming an enzyme/substrate complex

Products leaving active site of enzyme

After enzymatic action, substrate is converted, and products are released
Enzyme is ready for "re-use"

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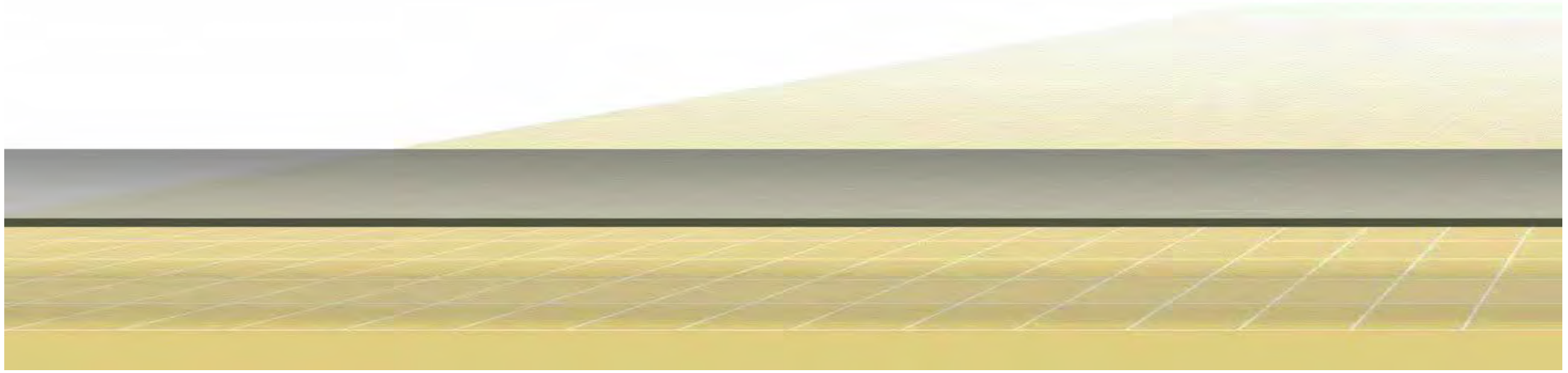
Enzyme Production Process

Short video



Benefits of enzymes in tortillas

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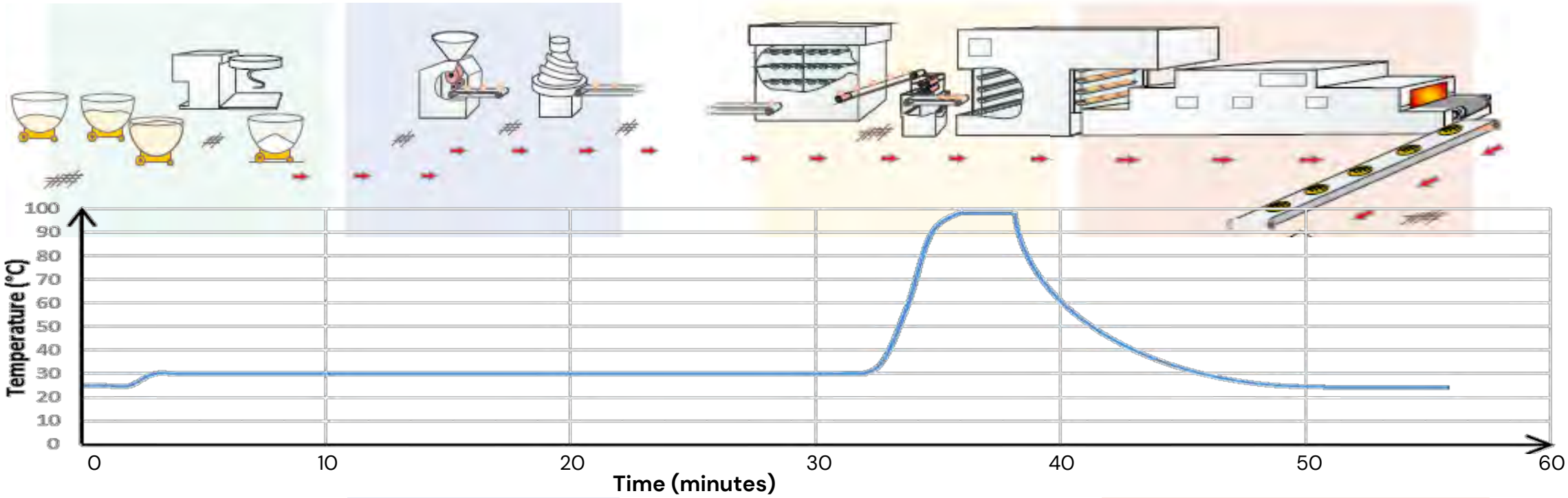
Role of enzymes during tortilla processing

Mixing | **Dividing & Molding** | **Resting & Pressing** | **Baking & Packing**



- Optimum dough development
- Improved water absorption
- Enhanced tolerance to raw material variations

- Improved machinability
- Smoother skin
- Improved process tolerance

- Improved dough stability/tolerance
- Improved shape and size

- Fluffy layered structure
- Contact spots
- Reduced sticking of tortillas
- Longer freshness

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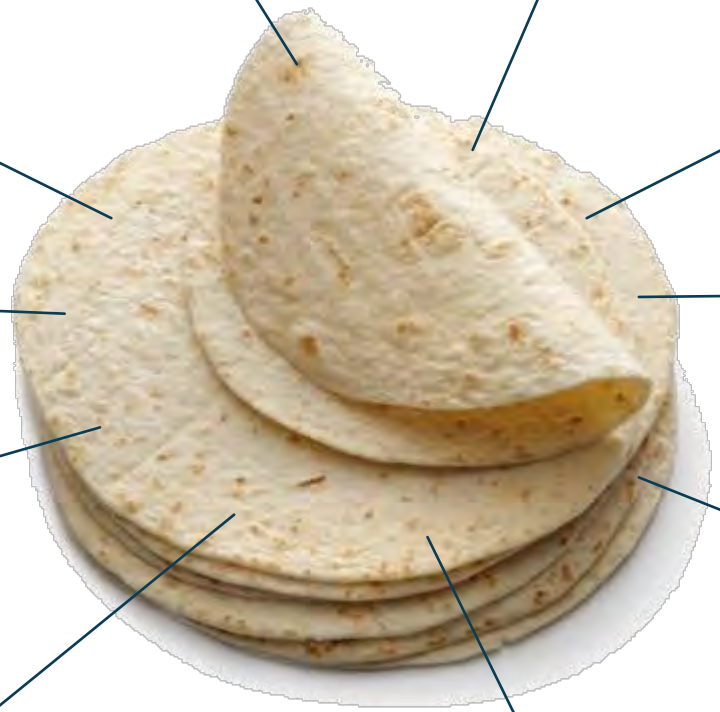
Challenges & Opportunities



Control dough properties

Improve diameter, round shape and smooth edges

Excellent rollability, flexibility and foldability over shelf life

Soft, smooth and silky texture

Fluffy layers and opacity

Control toast points and small pillows

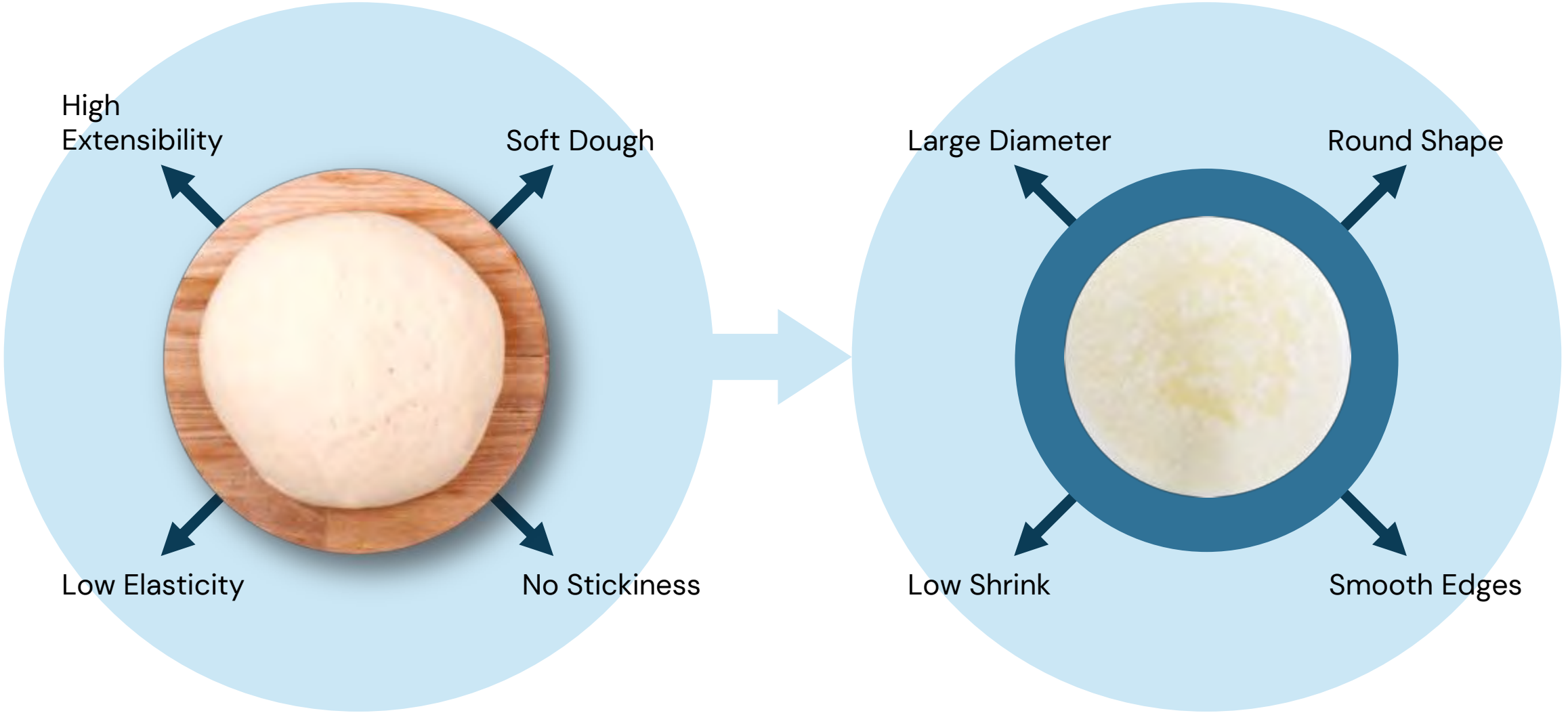
Increase strength to hold fillings

Cleaner label

Freshness over life: prolonged softness

Anti-sticking / Ease of separation

Controlling dough and press properties



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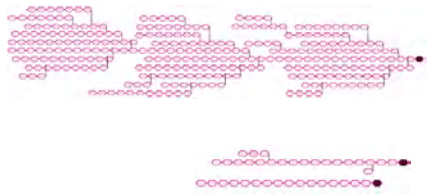
Wheat flour components

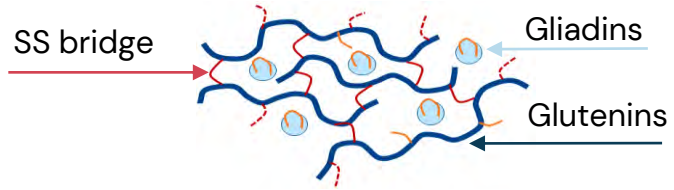
After removal of the bran and germ

	0	100	
Starch			65-70 %
Water			12-15 %
Protein			8-15 %
NSP			1-3 %
Lipid			1.5-3 %
Sugar			1-2 %
Mineral			0.5 %

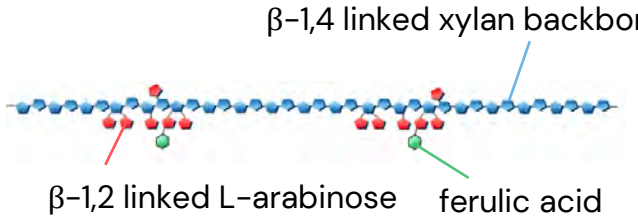
Starch



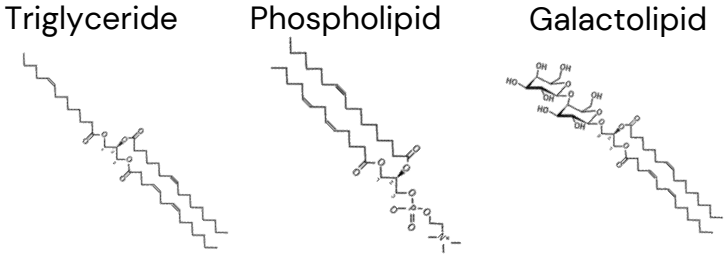
Proteins, in the Gluten network



Non-Starch Poly Saccharides



Lipids



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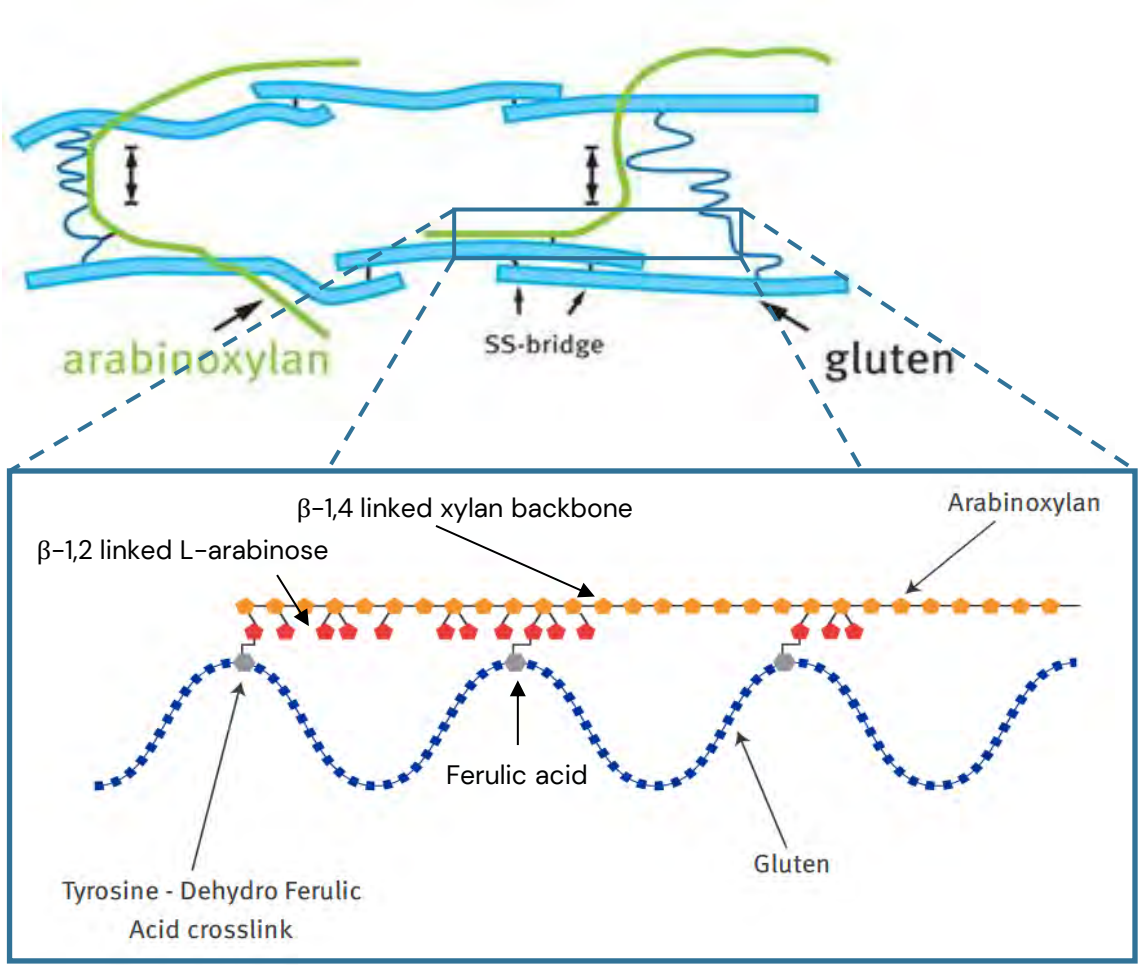
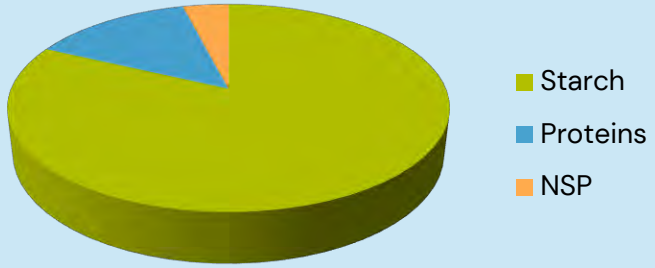
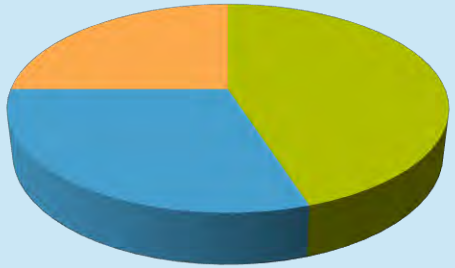
Non-Starch Polysaccharides (NSP)



Ratio of water absorbing components in flour

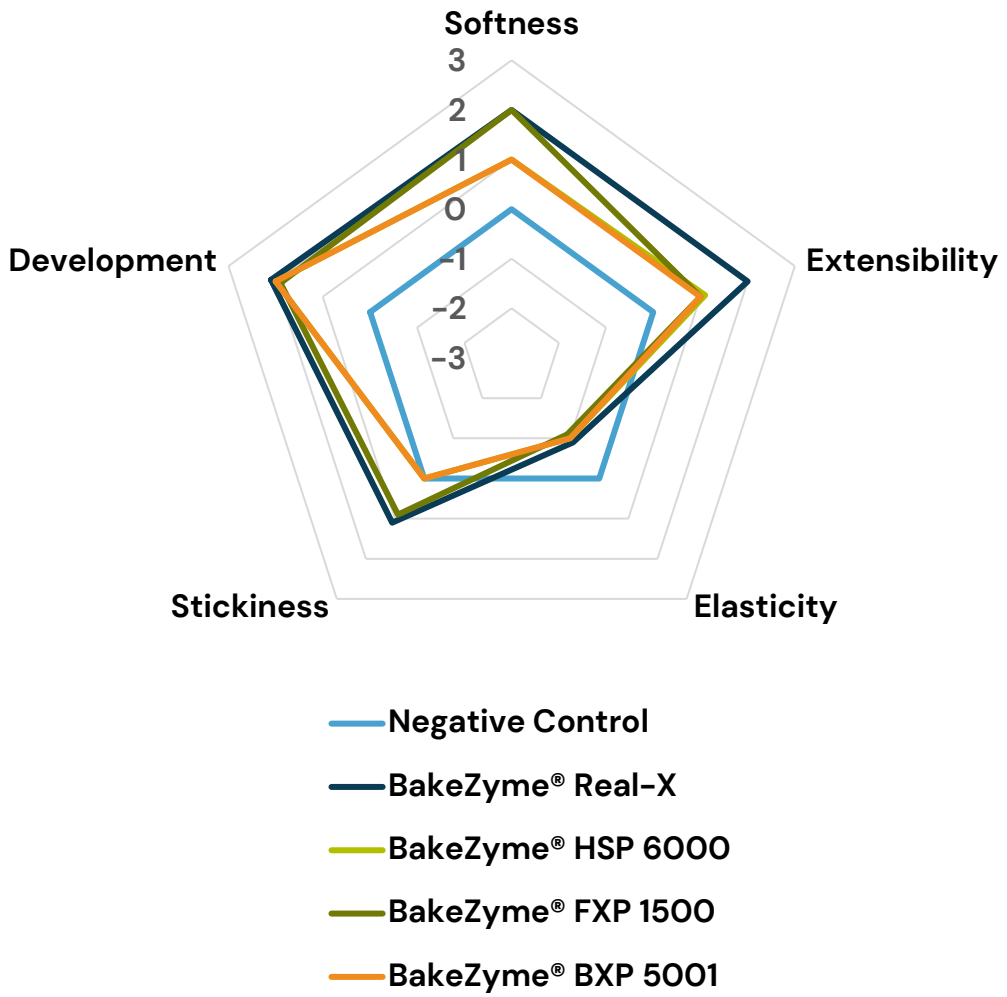


Contribution in water absorption



NSP are a minor component in flour but have a major contribution on the water absorption in a dough

Hemicellulases on dough conditioning



- Cons

Pros +

Risk of stickiness

Better dough development

Improved shape, extensibility

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Wheat flour components

After removal of the bran and germ

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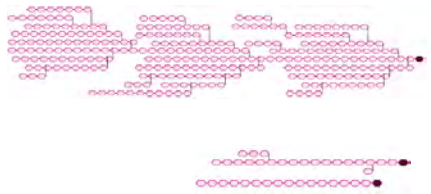
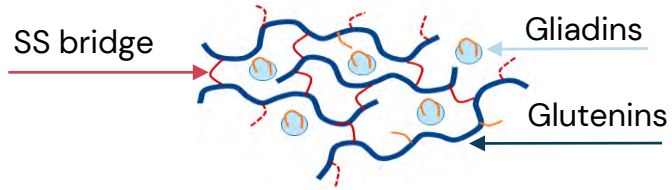
Starch



Proteins, in the Gluten network



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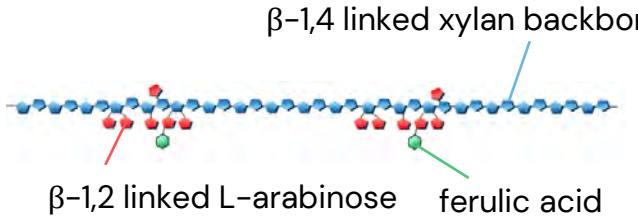
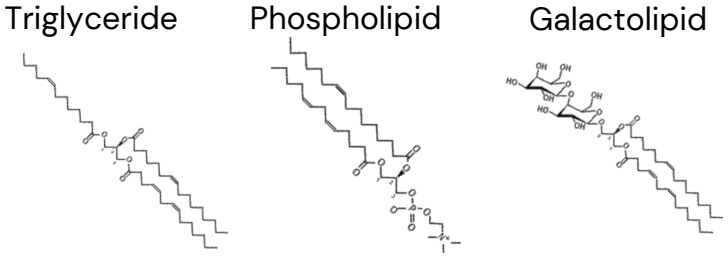


Lipids



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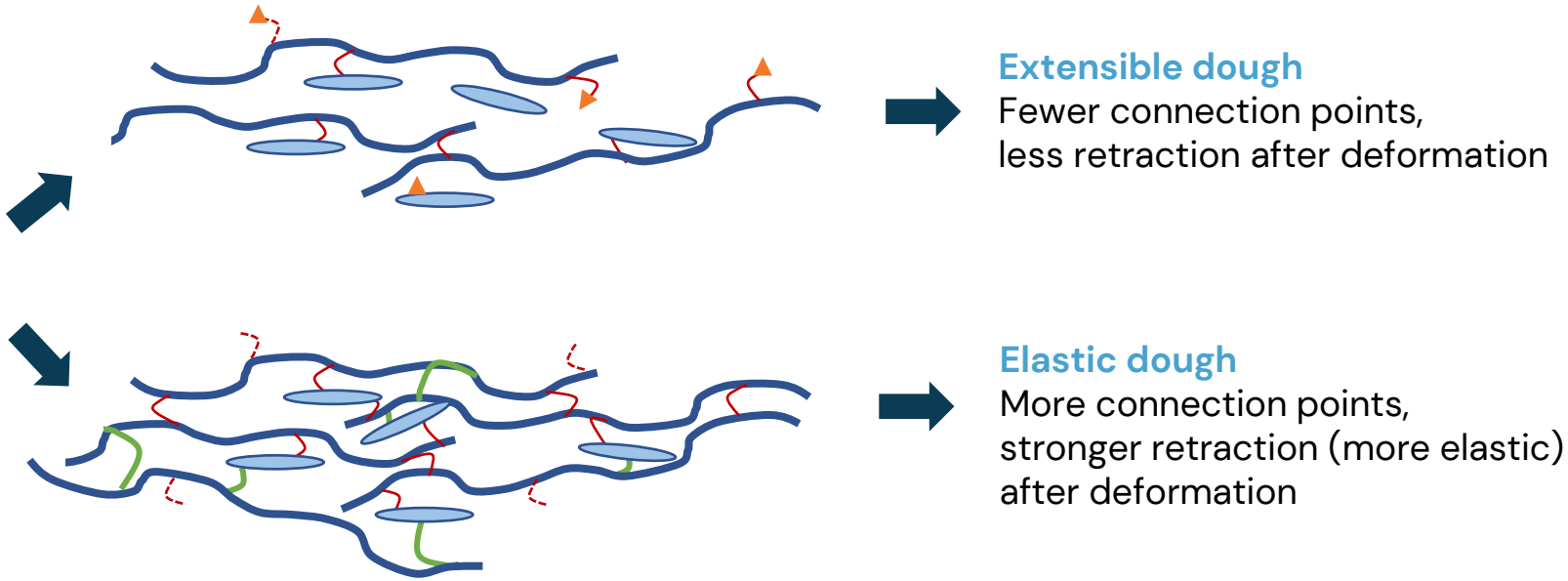
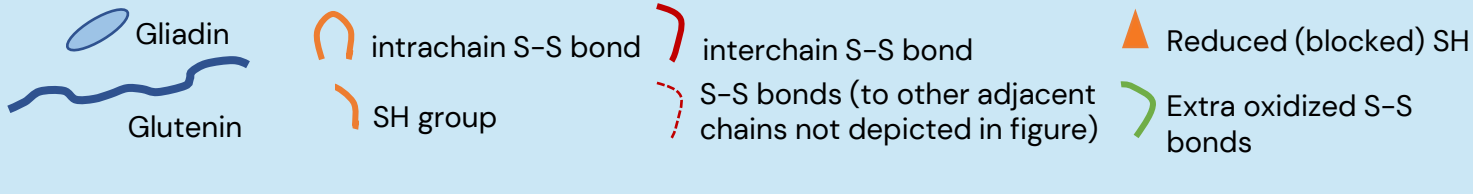
Extensible dough leads to a larger tortilla

Extensibility: stretch of dough without retracting



Extensible dough
Fewer connection points,
less retraction after deformation

Elastic dough
More connection points,
stronger retraction (more elastic)
after deformation



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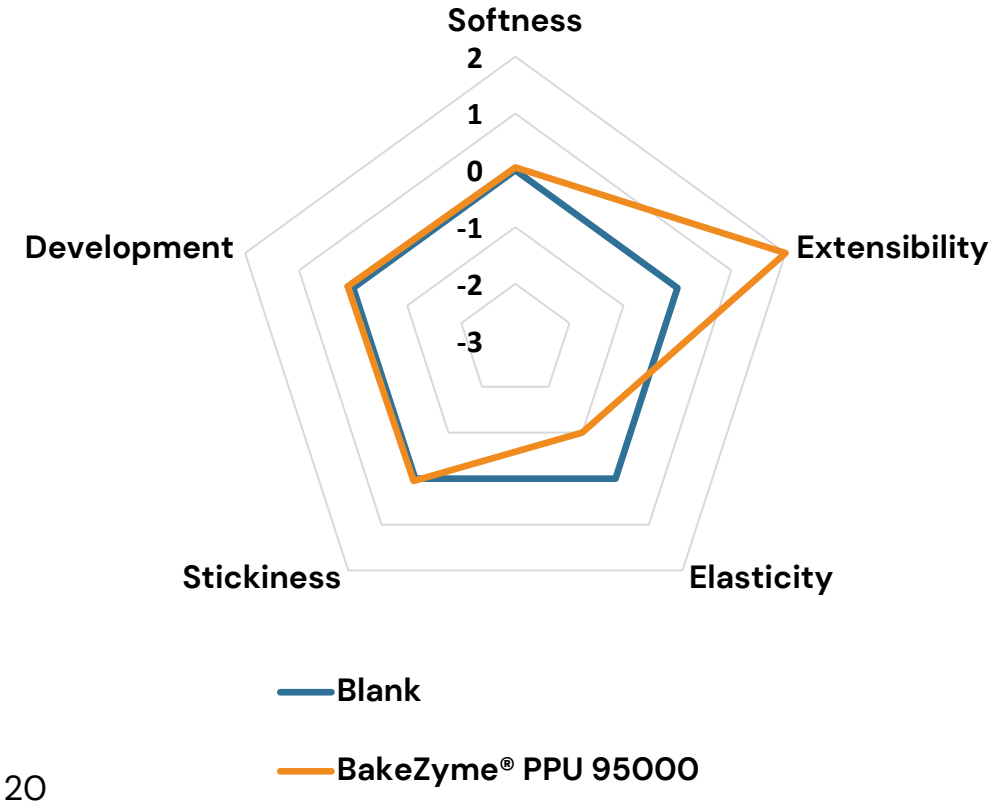
Dough properties – Extensibility

Proteases – act primarily on **gluten proteins**, which are responsible for dough strength and elasticity



Risk of stickiness ◀ ▶ Large diameter

Dough too weak ◀ ▶ Improved relaxation

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Dough properties – Elasticity

Glucose oxidase – creates hydrogen peroxide that helps to **strengthen and dry** wheat doughs

Too dry surface

Press ability

Better dough handling

Anti-sticking / dry surface

Improved shape

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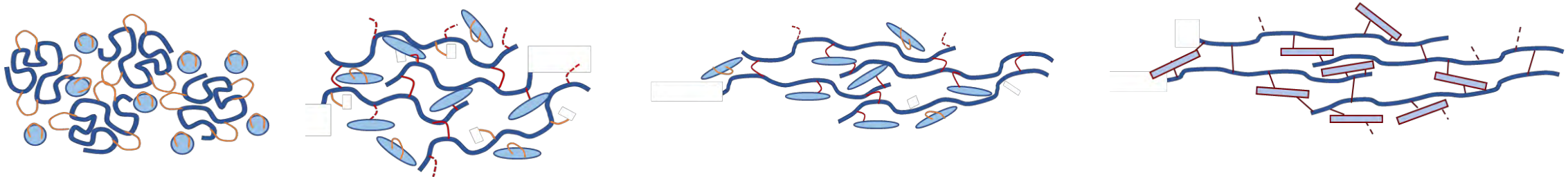
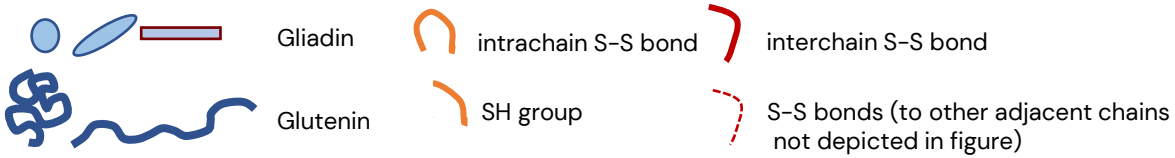
Changes in protein network during tortilla processing

Dough
(hydration + mixing)

Hot pressed / baked tortilla
(heating + deformation)

Stored tortilla
(gluten dehydration)





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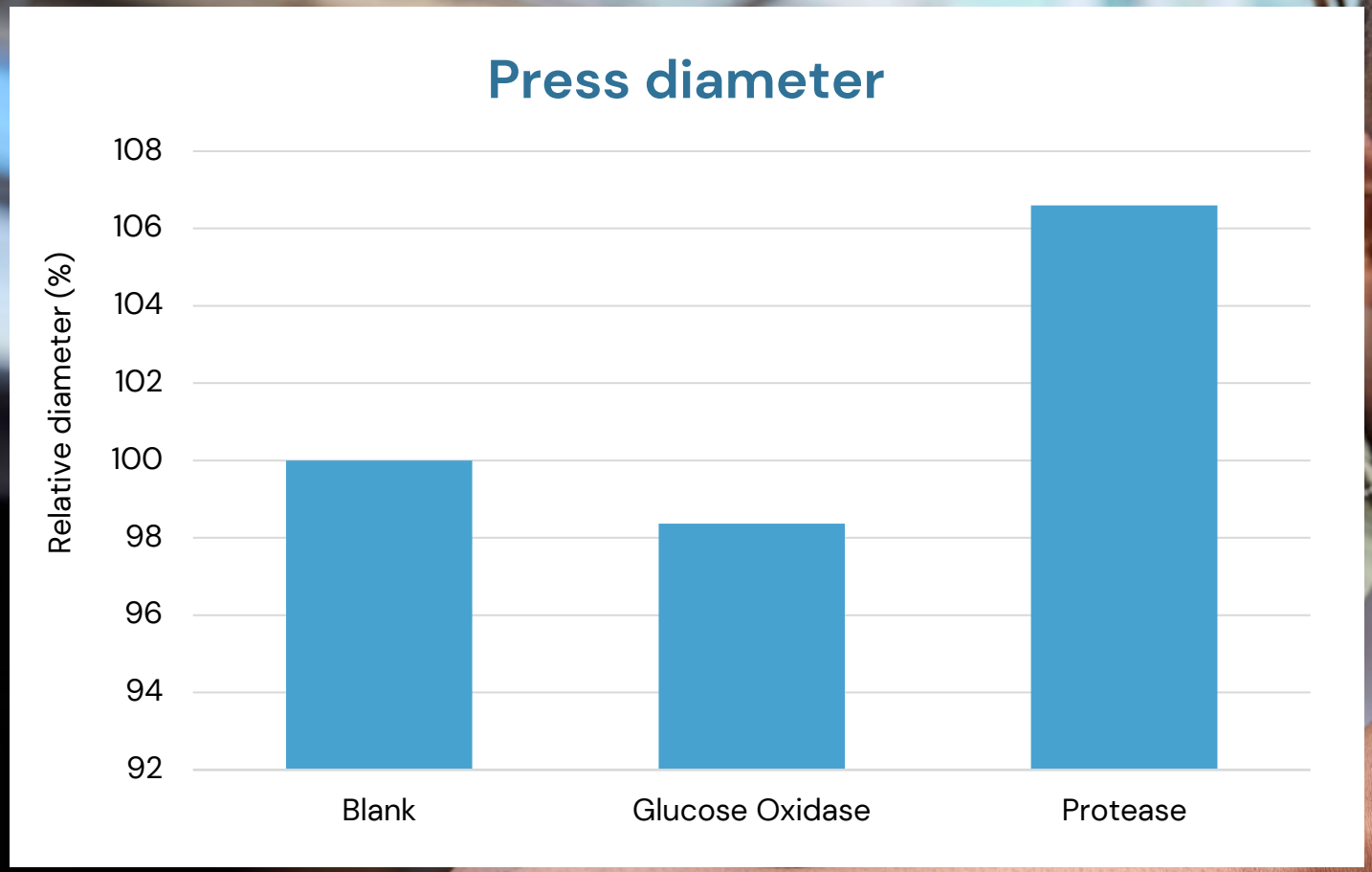
Effect of enzymes on diameter

Improved relaxation with protease



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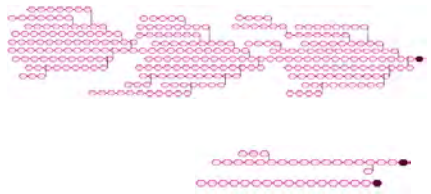
Starch



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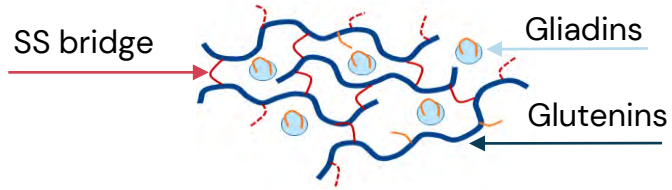

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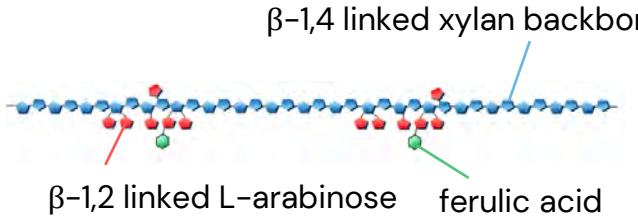
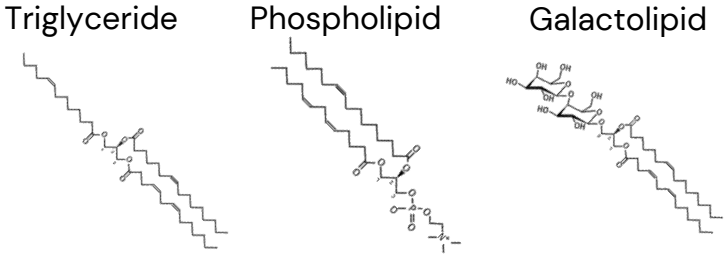


Lipids



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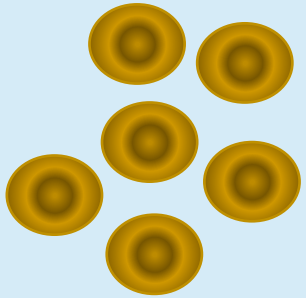
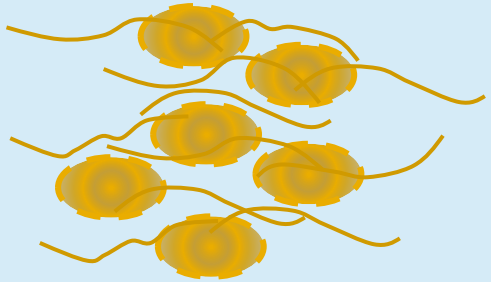
Changes in starch during tortilla processing

Dough



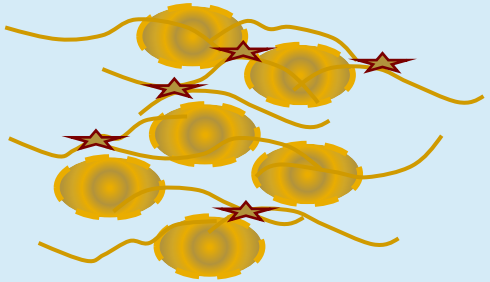
Semi-crystalline swollen starch granules

Pressed & baked



Molten, amylopectin-rich starch granules with leached out mobile amylose chains

Stale



Starch granules with interlocked, semi-crystalline, rigid and insoluble amylose network

Amylose plays a more prominent role in staling of tortillas than amylopectin

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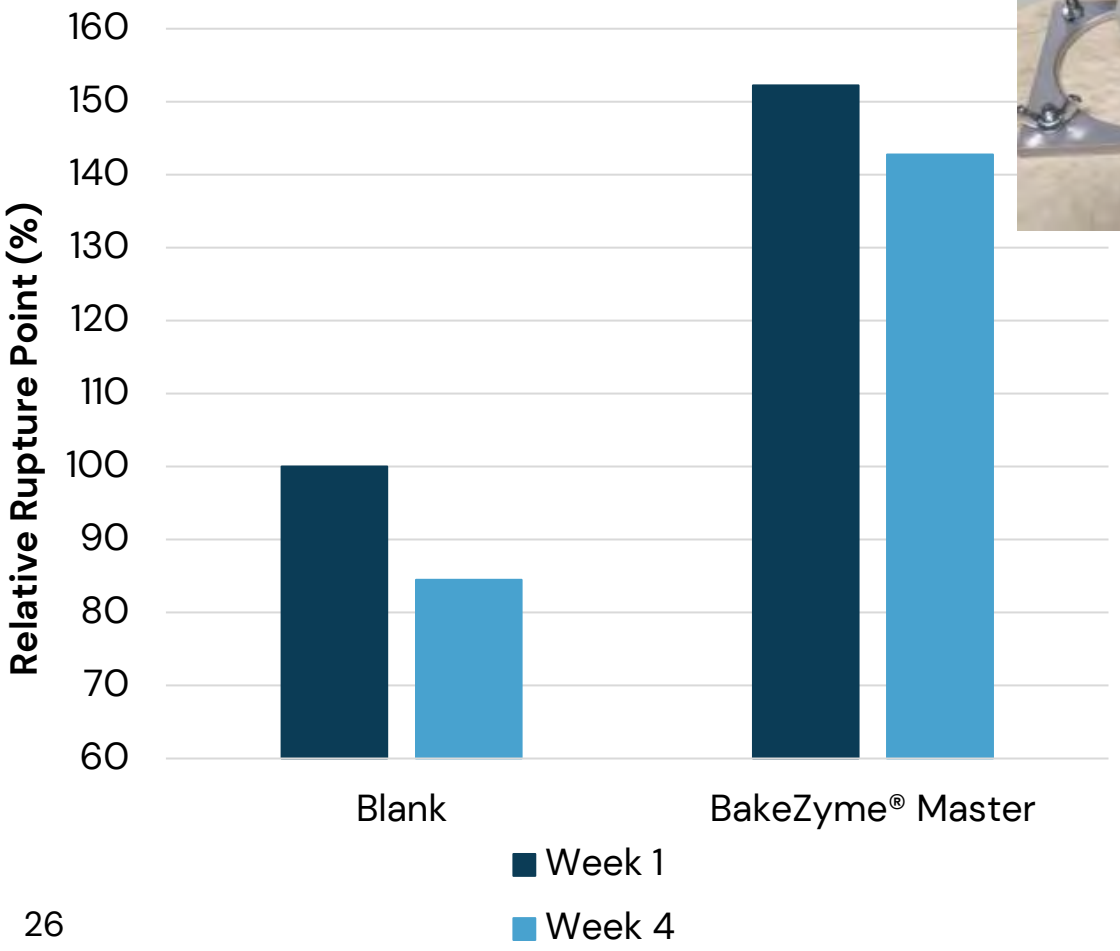
Prolonged freshness

Maltogenic amylases – modify amylose and amylopectin, which are responsible for staling.



Blank

BakeZyme® Master

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Which enzymes can help?

Summary

Functionality	Type of enzyme	What does it do?
Dough conditioning	Hemicellulase	Break down of **non-starch polysaccharides** for optimized **water distribution** in a dough system. This affects dough extensibility and/or elasticity.
Gluten modification	Protease Glucose Oxidase	**Protease** breaks down gluten to improve the **extensibility of the dough**. Oxidation of gluten by **glucose oxidase** creates a **stronger network.**
Longer freshness	Maltogenic Amylase	Modifies **starch** during the baking process to reduce retrogradation of starch and **minimize staling**.
Emulsification	Lipase	Modification of flour lipids and added fat to make structures with **emulsification** properties in-situ.

Toolbox wheat flour tortilla

		Dough				Tortilla			
Product	**Type**	**Dosage**	**Extensi-bility**	**Elasticity**	**Softness**	**Increased Size**	**Flexibility/ Rollability**	**Fresh keeping**	**Anti-sticking**
BakeZyme® BXP 5001	Bacterial xylanase	30-80ppm	●●○○	○○○○	●●○○	○○○○	○○○○	○○○○	○○○○
BakeZyme® HSP 6000	Fungal xylanase	20-60ppm	●●○○	○○○○	●●○○	○○○○	○○○○	○○○○	○○○○
BakeZyme® FXP 1500	Fungal xylanase	20-60ppm	●●●○	○○○○	●●○○	●○○○	○○○○	○○○○	○○○○
BakeZyme® Real-X	Fungal hemicellulase	1-8ppm	●●●●	○○○○	●●○○	●●●○	○○○○	○○○○	○○○○
BakeZyme® PPU 95.000	Fungal protease	10-50ppm	●●●○	○○○○	○○○○	●●●●	○○○○	○○○○	○○○○
BakeZyme® GO 10.000	Glucose oxidase	10-50ppm	○○○○	●●●○	○○○○	○○○○	●○○○	○○○○	●○○○
BakeZyme® Master	Maltogenic amylase	50-150ppm	○○○○	○○○○	○○○○	○○○○	●●●●	●●●●	○○○○
Panamore® Golden	Phospholipase	10-50ppm	○○○○	○○○○	●●○○	○○○○	●●○○	●○○○	●●○○

Not effective: ○○○○ Little effective: ●○○○ Somewhat effective: ●●○○ Effective: ●●●○ Very effective: ●●●●

Check regulatory status for approved countries

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If you want to know more...

Go to the podcast episode 1

Download the whitepaper

Thank you / questions?

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