



Water Absorption for Optimal Dough

When baking bread, flour and water are two key ingredients for a successful loaf. Flour, derived from wheat through a complex milling process, is the primary ingredient in bread recipes. However, it's important to note that the quality of the flour depends heavily on the steps that come before it.

Water is also critical in bread baking, closely behind flour's importance. Whether baking on an industrial scale or using artisanal methods, water plays a crucial role in bread—particularly when forming dough.

Water transforms the ingredients into a cohesive dough. It's vital to understand its importance and ensure that the dough has the perfect consistency for the exceptional quality of the final baked product.¹²



Water Absorption & Its Impact on Products

Understanding the concept of water absorption is essential for bakers, as it allows them to control the hydration process effectively and ensure the desired outcomes regarding the finished baked goods' sensory and physical properties.

Water absorption refers to the capacity of flour to absorb water, playing a crucial role in achieving the desired consistency and creating a high-quality final product. Here are some critical points about water absorption:

- **Competition:** different compounds compete to absorb the liquid when water is added and mixed with flour, impacting the overall hydration process.
- **Gluten matrix:** water is crucial in hydrating the flour's gluten-forming proteins and other dough-forming ingredients.
- **Dough formation:** the hydration process occurs as the flour absorbs water, forming a consistent texture known as dough.
- **Impact on the final product:** the level of water absorption significantly affects the sensory properties of the final product, including texture, color, and even shelf life.



Understand dough behavior with the Mixolab 2 from KPM Analytics! It allows you to get as close as possible to the actual conditions of how the flour will be used in baked goods. The instrument measures the consistency of the dough and analyzes the quality of the protein and starch. [Learn more.](#)

Under Absorption⁹

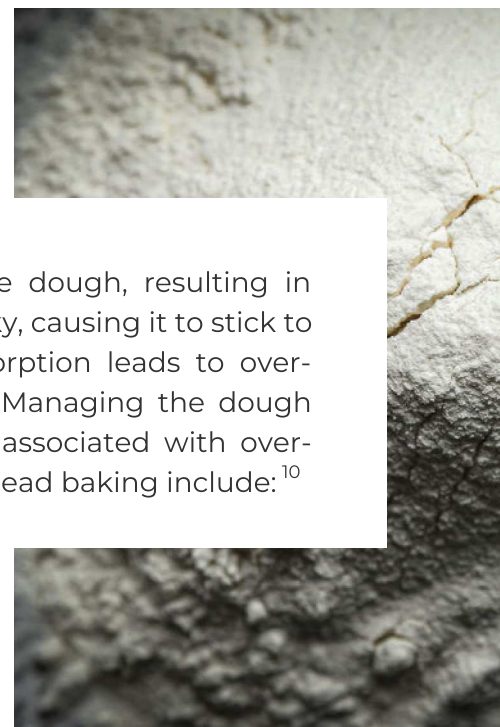
Not adding enough water can have adverse effects on the dough. Insufficient water makes the dough easier to handle but lacks the essential stretchiness. This condition, known as under-absorption, occurs when the dry ingredients are not adequately hydrated and dispersed. Some of the expected effects of under absorption are:

- Inadequate pan flow causing uneven distribution and bubbles in the bread
- Dry and stiff dough
- Slow proofing
- Under-fermentation and lack of final development
- Dense and firm crumb structure
- Quick staling of the bread
- Reduced final volume
- White underdeveloped corners of the bread

Over Absorption⁹

Over-absorption occurs when too much water is added to the dough, resulting in various challenges. Adding excessive water makes the dough sticky, causing it to stick to surfaces and making it difficult to handle. Moreover, over-absorption leads to over-fermentation, where yeast activity becomes more pronounced. Managing the dough and achieving optimal hydration is crucial to avoid the pitfalls associated with over-absorption in baking. The common effects of over-absorption in bread baking include:¹⁰

- Wet dough
- Extended clean-up time
- Sticky dough
- Over fermentation
- Hard to handle the process
- Final product disposed to mold
- Final product with open crumb grain and large cells
- Large volume but poor symmetry



Getting It Right

Under-absorption and over-absorption in bread baking leads to poor physical and sensory properties. Achieving the correct water balance is crucial for optimal dough handling and the desired quality of the final product. Water absorption affects dough and the final product's physical properties, seen through rheological characteristics and consistencies.

Rheological properties are fundamental characteristics that describe how dough responds to applied forces, providing valuable insights into its texture, flow, and overall behavior during baking. These properties encompass a range of factors, including tenacity, elasticity, and extensibility, which all influence the dough's handling, shaping, and final product quality.

Dough consistency, on the other hand, refers to the physical state and texture of the dough, reflecting its firmness, pliability, and overall structure. It is a critical aspect of dough development that directly impacts the success of various baking stages, such as mixing, proofing, shaping and baking. The correct dough consistency is essential for proper gas retention, optimal gluten development, and the formation of a desirable crumb structure.

Quality Assessment Tools for Water Absorption

Determining the ideal water content for your dough formulation is essential, and it can be assessed by evaluating the consistency of the dough. Achieving the right consistency directly impacts the quality of the final product. At the artisanal baking level, any negative repercussions resulting from inconsistent dough consistency can be easily corrected.

However, in industrial baking, the margin for error is narrower, emphasizing the importance of precise and consistent water absorption in the flour during secondary processing. The flour used in industrial baking requires optimal and consistent water absorption characteristics to ensure consistent and high-quality results.

THE CONVENTIONAL METHOD

Traditionally, bakers have relied on manual processes to assess dough consistency using the sense of touch. However, there are inherent issues with this approach:

- Subjectivity and operator dependency
- Lack of precision
- Limited understanding

Considering these manual consistency evaluation limitations, there is a growing need for more objective and precise methods to ensure consistent and high-quality dough.

Controlling Water Absorption

Various analytical tools have been developed in the baking industry to objectively assess water absorption and dough consistency. These tools utilize advanced technology to provide precise measurements and insights. Analytical tools provide objective data, reducing subjectivity and variability in dough control. Bakers use these technologies to optimize water absorption for consistent, high-quality dough and improve final product outcomes.

It is important to recognize that mixing is not the final stage in the baking process. The behavior of the dough during other steps, such as shaping, fermentation and baking, also plays a crucial role in the final product. Additionally, even if two flours have the same total water absorption value, they can have different compositions, leading to distinct behaviors throughout the baking process.

With its ability to modify the temperature throughout the test, the Mixolab 2 emerges as the most appropriate instrument for assessing water absorption and dough characteristics. It also enables anticipation of the entire baking process.

Flour components that affect water absorption & dough characteristics:

Protein/Gluten	Constitutes between 7% and 17% (dry matter basis) of the flour. It has the capacity to absorb approximately two times its weight in water. The more protein/gluten, the more water absorption. ⁶
Damaged Starch	The level of damaged starch in flour affects water absorption, with higher levels resulting in increased absorption. It can increase the water absorption levels by as much as three times. Damaged starch also contributes to dough stickiness.
Pentosans	Pentosans in flour have a remarkable water absorption capacity. They can absorb up to 15 times their weight in water. The presence of water-holding pentosans significantly enhances dough viscosity.

Understanding water absorption in flour allows bakers to optimize mixing, fermentation and baking. Bakers can achieve desired dough consistency and produce high-quality baked goods by considering flour's composition and water absorption properties.

Methods for Tracking Water Absorption

To achieve a balanced dough consistency and optimize water absorption rates, you can go beyond traditional methods and utilize analytical analyzers, such as the one provided by [KPM Analytics](#) equipment.

- Techniques like [near-infrared spectroscopy \(NIRS\)](#) offer rapid measurements of wheat flour composition such as protein, starch, fibers, moisture content, etc.^{5,11}
- The [Alveolab](#) focuses on water absorption and protein quality, measuring dough tenacity, extensibility, and elasticity to delve deeper into dough properties.⁴
- The [Mixolab 2](#) comprehensively analyzes water absorption and dough characteristics, including protein, starch, fibers, and their interactions, giving bakers valuable insights into baking.³
- The [SDmatic](#) accurately measures damaged starch in flour, a key parameter to avoid many difficulties during processing.¹
- By understanding the sources of water absorption through tools like the [SRC CHOPIN 2](#), bakers can better appreciate their dough and explore quality solutions.²

EFFECTIVELY CONTROL YOUR DOUGH

In bread baking, understanding and effectively controlling dough consistency throughout the entire process is paramount to maintaining consistent product quality. Both under-absorption and over-absorption of water can result in technological challenges during production, leading to significant economic implications and inconsistencies in the final product. It is vital to measure the water absorption rate and comprehend its impact on the behavior of the dough and, ultimately, the characteristics of the finished products.

By comprehensively analyzing water absorption and its effects on dough behavior and final product attributes, you can make informed decisions to achieve optimal dough consistency and ensure consistent quality in your bread products. This holistic approach to water absorption and dough management is essential for attaining desirable outcomes and meeting consumers' expectations.

“ Which ingredients increase water absorption?

The ingredients that can increase water absorption during baking include:

- High protein flours, such as bread flour or high-gluten flour, contain proteins like gluten that can absorb water and increase its absorption capacity.
- Due to their higher fiber content, whole grains and bran can absorb water and require additional liquid in the dough.
- Damaged starch has a direct impact on flour's properties and functionality. It can significantly increase water absorption capacity.
- Enzymes, such as amylase and protease, can modify the structure of the ingredients present in dough by breaking down starches and proteins, leading to modified water absorption.
- Hydrocolloids like xanthan gum, guar gum, or cellulose gum, commonly used as additives, possess water-binding properties that enhance water absorption in the dough.

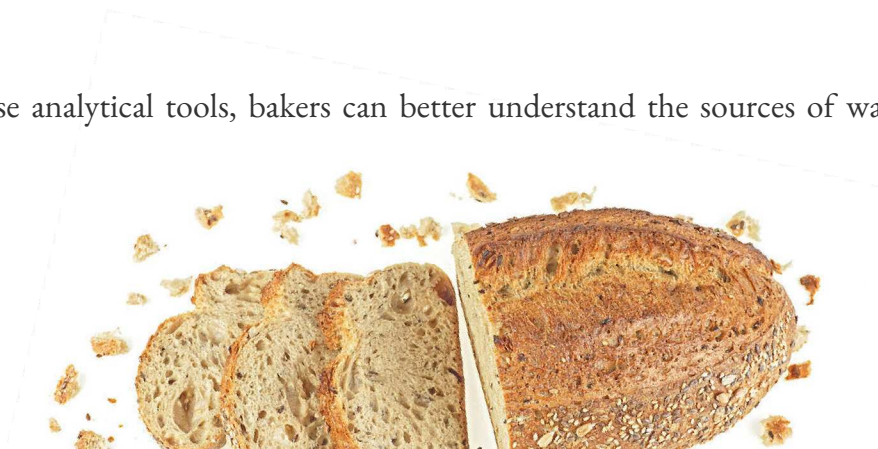
“ What is the best analytical tool to measure the water absorption of artisan bread?

When measuring the water absorption of artisan bread, it is beneficial to use a combination of analytical tools as they each provide insights into different aspects of dough properties.

State-of-the-art equipment options include:

- Near-infrared spectroscopy (NIRS)
- Alveolab
- Mixolab 2
- SDmatic

By utilizing these analytical tools, bakers can better understand the sources of water absorption in their dough.



“ Does water absorption affect the water activity in the finished product?

Water absorption in dough does affect the water activity (a_w) of the final product, which is a measure of available water for microbial growth and chemical reactions. As the dough absorbs water, it becomes bound within the structure, reducing the amount of free water and lowering the water activity. Controlling water absorption during baking is crucial for achieving the desired water activity, preserving product quality, and extending shelf life. Bakers can effectively manage water activity by optimizing water absorption levels and maintaining desired texture and sensory attributes.



This BAKERpaper is brought to you by KPM Analytics. For over 100 years they've supplied instruments that measure critical quality parameters, analyze products during the baking process, and ensure final product quality. Their comprehensive range of analyzers are used by food producers to improve efficiency, ensure quality and protect their brand. [Get started here!](#)



**Measuring quality
at every step of the process**



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