



# A FORMULATED SYSTEM IS DURABLE

What looks stable can collapse under pH, heat, and time without the right system



## BUILT TO LAST... OR FAIL

Most reduced-sugar formulations don't fail in development. They fail in the real world, where time, temperature, pH, water activity, and packaging begin to stress the system. What looks stable on day one—balanced sweetness, acceptable texture, and a clean label—can quickly break down into viscosity drift, moisture migration, structural collapse, and consumer complaints. This isn't bad luck. It's a system that was never designed to hold.

In beverages, especially RTDs, stability is constantly under attack. Acid, heat, shear, oxygen, and time all act on a formulation that no longer has sugar to provide structure. Fiber selection becomes critical. Some fibers, like inulin, may perform well initially but hydrolyze under acidic conditions, leading to thinning and loss of body over shelf life. Others, such as PHGG and soluble tapioca fiber, offer greater stability and help maintain viscosity over time. Designing for day-one performance is not enough. Systems must be built to withstand real-world conditions.

In bars, the challenge shifts to water activity and moisture redistribution. Over time, water moves between components, proteins tighten, and textures change. Bars that begin soft and compliant can become hard and brittle or, conversely, sticky and unstable. The issue is not sweetness, it's water control. Fiber systems play distinct roles: soluble tapioca fiber manages water, polydextrose supports humectancy, and inulin contributes to early texture. When these elements are not balanced, texture failure is inevitable.

Baked goods face a similar reality. From the moment they leave the oven, moisture migration and starch retrogradation begin to degrade quality. Without proper control, products develop dry interiors, sticky exteriors, and shortened shelf life. Effective systems require both water-binding and humectant components working together to maintain structure and softness.

The takeaway is clear: sugar reduction is not an ingredient swap. It is a system-level challenge. Sweeteners address perception, but fibers and formulation strategy determine whether a product holds up over time. Success depends on building layered systems that manage water, structure, and stability from production through shelf life.



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**\*This is part 3 of a 3 part series on fiber.**

# FAST FACTS

**1. Most failures happen after launch** Reduced-sugar products often perform well in development but break down over time due to pH, heat, water activity, and storage conditions.

**2. Sugar did more than sweeten** Beyond taste, sugar provided structure, water control, and stability—functions that must be rebuilt in reduced-sugar systems.

**3. RTDs are the toughest environment** Acid, heat, shear, oxygen, and time all act simultaneously, making fiber stability and viscosity control critical to shelf-life performance.

**4. Bars fail because of water, not sweetness** Texture changes like hardening, stickiness, or brittleness are driven by moisture migration and water activity imbalance.

**5. No single ingredient solves it** Successful formulations rely on layered systems, where fibers, sweeteners, and humectants each play a specific role in stability and performance.



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# FAQ

## 1. Why does inulin lose functionality in acidic RTD systems over shelf life?

Inulin is susceptible to acid-catalyzed hydrolysis, particularly under low pH, elevated temperatures, and extended storage. This hydrolysis reduces chain length, which directly affects its contribution to viscosity and body. The result is a gradual thinning of the system over time, even if initial performance appears acceptable. This is why inulin must be carefully evaluated or supported within acidic beverage systems.

## 2. How do different fiber types influence viscosity stability in RTDs?

Fiber stability depends on molecular structure and resistance to processing stress. PHGG and soluble tapioca fiber maintain structural integrity under heat, shear, and low-pH conditions, allowing them to deliver more consistent viscosity throughout the shelf life. In contrast, fibers that degrade or depolymerize under these conditions may show acceptable day-one viscosity but fail to maintain it over time, leading to phase instability and poor mouthfeel.

## 3. What role does water activity play in bar texture evolution over time?

Water activity governs moisture mobility within the system. Over time, water migrates from higher- to lower-activity zones, driving protein tightening, syrup equilibration, and structural changes. If water activity is not properly balanced, this redistribution leads to hardening, brittleness, or stickiness. Maintaining target aw ranges and incorporating appropriate water-binding and humectant components is critical to preserving texture.

## 4. Why is a combination of water binders and humectants necessary in baked goods?

Water binders, such as soluble tapioca fiber, immobilize water and help maintain structural integrity, while humectants like polydextrose keep water functionally available to prevent drying and staling. Relying on one without the other creates an imbalance—either trapping water too tightly or allowing excessive migration. Effective systems require both mechanisms to work together to control moisture throughout shelf life.

## 5. Why can't a reduced-sugar formulation be approached as a one-to-one ingredient replacement?

Sugar serves multiple functional roles simultaneously, including bulk, water-binding, viscosity, and preservation. Replacing it with a single ingredient fails to replicate this complexity. Reduced-sugar systems must be designed as multi-component frameworks, where each ingredient is selected to replace a specific function. Without this system-level approach, products may meet initial targets but fail under real-world conditions.



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