UNFAZED

STABILITY IN HEAT AND ACID

Molecular structure makes the difference in real-world formulations

When formulating today's acidified beverages, fiber performance isn't just about nutrition or label claims. It's about how ingredients behave under real processing conditions. Heat. Acid. Time. That's where the difference between fibers becomes clear.

This white paper takes a practical, side-by-side look at two popular clean-label fibers: chicory root inulin and FibRefine™ Soluble Tapioca Fiber. Both are valued for prebiotic benefits and formulation versatility, but under acidic, high-heat conditions, they don't perform the same.

In controlled testing that mirrors typical beverage processing, inulin showed signs of breakdown when exposed to low pH and pasteurization temperatures. As its molecular structure begins to break apart, small amounts of sugars can form, and viscosity may shift over time. These changes can introduce unwanted sweetness, labeling concerns, or inconsistencies in finished products.

FibRefine™ Soluble Tapioca Fiber, by contrast, remained remarkably stable. Thanks to its branched molecular structure, it resisted acid and heat stress, maintaining greater than 99% structural integrity with no detectable sugar release. Viscosity stayed consistent, and fiber content held firm throughout processing.

What does that mean for formulators? Fewer surprises, more predictable performance, and greater confidence that what goes in, comes out in the finished product.

For beverage developers working in low-pH environments, this paper highlights why molecular structure matters and why fiber selection can have a real impact on stability, labeling, and overall product quality.

FibRefine™ Soluble Tapioca Fiber delivers clean-label fiber that stays unfazed when conditions get tough, helping brands create better-for-you beverages without compromising performance.

Thermal–Acidic Stability: Head-to-Head at pH 3.9 and 160–170°F

Condition	PreBiotica™ Inulin	FibRefine™ Soluble Tapioca Fiber
pH 3.9	Stable for short exposure; minor hydrolysis (~5%)	Excellent stability; no measurable hydrolysis
Temperature (160–170°F)	Polymer integrity >90–95% after 12 min	>99% stability under identical conditions
Exposure Time (8–12 min)	Minor scission at longer dwell	Negligible structural loss
Residual Sugar Formation	Trace fructose/glucose detectable	None detected
Viscosity Shift	Slight reduction over time	Stable rheology throughout process

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FAST FACTS

Proven Heat & Acid Stability
FibRefine™ STF maintains >99% structural integrity at beverage pH (~3.9) and pasteurization temperatures of 160–170°F.

No Sugar Surprise
Shows no detectable sugar release, helping protect sweetness control and label integrity.

Consistent Texture
Delivers stable viscosity throughout processing, with no drift over time.

Built for Beverage Applications
Ideal for acidified beverages, tonics, and functional drinks where fiber performance is critical.

Processing-Ready
Fully compatible with UHT, pasteurization, and retort processing conditions.

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FAQ

1. **What molecular features drive FibRefine™ Soluble Tapioca Fiber's superior stability under heat and acid?**

   Answer: FibRefine™ Soluble Tapioca Fiber is composed of randomly branched α-linked glucan structures, including α-(1-2), α-(1-3), and α-(1-6) bonds. This branching creates steric hindrance that limits proton accessibility to glycosidic linkages under acidic conditions. In contrast, linear fructan structures such as chicory root inulin rely primarily on β-(2-1) linkages, which are more susceptible to acid-catalyzed hydrolysis. The combination of branching and α-linkages significantly slows chain scission under combined thermal and pH stress.

2. **How was fiber integrity evaluated under simulated beverage processing conditions?**

   Answer: Stability was assessed under controlled conditions representative of acidified beverage processing, including pH ~3.9 and temperatures of 160–170°F over typical pasteurization dwell times. Polymer retention and degradation were evaluated using validated analytical methods, including AOAC-aligned carbohydrate analysis and chromatographic detection of low-molecular-weight sugars. These methods allow differentiation between intact fiber polymers and hydrolysis byproducts such as glucose or fructose.

3. **Why does acid-induced hydrolysis pose a formulation risk beyond sweetness changes?**

   Answer: Partial hydrolysis of fiber polymers can have cascading formulation effects beyond incremental sweetness. Liberation of mono- and disaccharides may impact glycemic response, labeling compliance, and claims related to added or intrinsic sugars. Additionally, polymer scission alters molecular weight distribution, which can affect viscosity, mouthfeel, and long-term physical stability. These risks often emerge late in development or post-launch, making upfront fiber selection critical.

4. **Does FibRefine™ maintain prebiotic functionality despite its enhanced stability?**

   Answer: Yes. FibRefine™ Soluble Tapioca Fiber retains resistance to digestion in the upper gastrointestinal tract while remaining fermentable in the colon. Its controlled molecular weight distribution and branching support selective fermentation by beneficial gut microbiota without rapid breakdown during processing. This allows formulators to deliver prebiotic benefits without compromising processing resilience or label integrity.

5. **How does processing compatibility influence fiber selection for modern beverage systems?**

   Answer: Modern beverage systems frequently involve aggressive processing, including UHT, extended pasteurization, and retort conditions. Fiber ingredients must therefore tolerate both thermal and acidic stress without structural degradation. FibRefine™ Soluble Tapioca Fiber demonstrates compatibility across these processing regimes, offering formulators a functional fiber that aligns with clean-label goals while minimizing formulation risk in scaled manufacturing environments.

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