Novel Clean Label Stability Solutions: Functional Native Starches

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Defining stability and industry standards

It takes the concentrated efforts of industry experts to design and market clean label products. Delivering these products on an industrial scale can be challenging. From processing and transportation to storage and preparation, clean label foods are put through their paces.

Food products must withstand numerous physical rigors and temperature changes to deliver appealing texture, appearance and taste throughout their specified shelf life. To achieve success, it's crucial to choose ingredients that deliver excellent quality and stability.

Although traditional stabilizers, such as modified food starches and gums provide stability, these ingredients do not support clean labeling. Industry standards are evolving to include clean label ingredients, specifically those that can withstand the harsh rigors of modern food processing and offer equivalent shelf life stability to the modified standards — all with a simple, consumer friendly label.

Introduced more than a decade ago, functional native starches are a well-established solution for clean label formulations. Functional native starch ingredients are different from traditional native starches, such as corn starch. Through proprietary processing, they possess the functionality of modified starches, but can be labeled simply according to their base description (e.g., corn starch, tapioca starch, rice starch, potato starch).

To better understand how functional native starches perform in terms of stability, a research project was conducted, which yielded positive results supporting their numerous functional benefits.

Stability's impact on product development

An end product's stability can be affected by a number of variables along its journey from manufacturer to retail shelf, including:

- High pasteurization temperatures
- Physical rigors, such as intensive shear during processing
- Temperature fluctuations
- Repeated freeze/thaw cycles

A fruit preparation was one of the applications chosen for this study. Samples were tested at ambient, frozen and refrigerated conditions for a specified period of time.

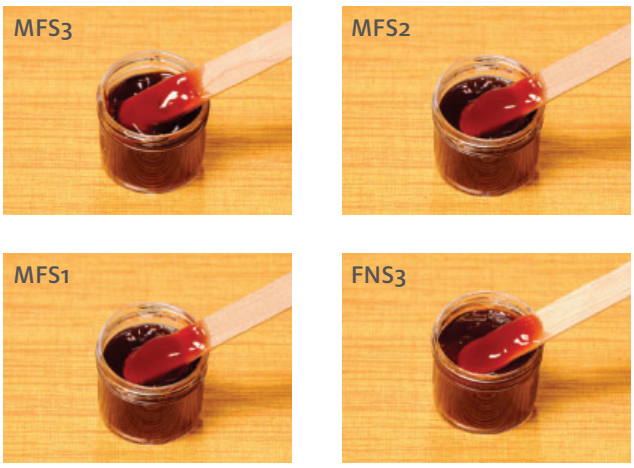
The research objective accounted for this complexity. The aim of the project was to gain the most comprehensive understanding yet of functional native starch's stability across different applications and storage conditions. Through this knowledge, manufacturers will be able to achieve stability in clean label products, by selecting the appropriate functional native starch.

Research methodology

The first step in the methodology was to identify appropriate applications for testing. The research team selected three applications with different storage requirements — chilled, ambient, and frozen. The formulations selected differed as well in pH, ingredients used, and processing. These were:

- Fruit preparation (for refrigerated yogurt)
- Retorted cream soup (shelf stable, can/jarred)
- Frozen beef gravy (sauce for frozen ready meal)

FIGURE 1: REFRIGERATED FRUIT PREPARATIONS



After 12 weeks of refrigerated storage, functional native starch 3 (FNS3) provides comparable textural stability to traditional modified food starches (MFS) tested.

A range of starches were selected and used depending on the formulation, process and storage requirements. Up to ten starches were evaluated depending on the application. Four modified starches, the industry benchmarks for stability, were compared to select functional native starches. The samples were then tested in the different applications for freeze/thaw, refrigerated and ambient stability as appropriate, using the methods outlined below.

Testing methods

Freeze/thaw stability

- Samples placed in freezer at 20°F (-7°C) until frozen
- Samples removed from freezer and thawed at ambient temperature
- Process repeated for a predetermined number of cycles (length of test depends on application)
- Evaluated for presence of syneresis, gelling and graininess evaluated after stirring at each freeze/thaw cycle

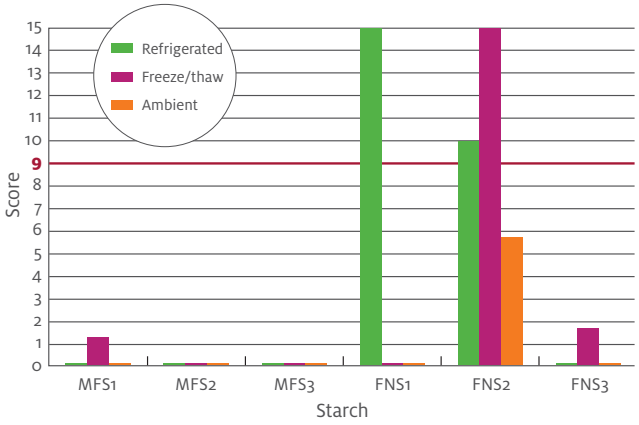
Refrigerated stability

- Samples placed in refrigerator at 40°F (4°C)
- Evaluated for presence of syneresis, gelling and graininess weekly for a predetermined number of weeks (length of test depends on application)

Ambient stability

- Samples stored at ambient conditions
- Evaluated for presence of syneresis, gelling and graininess weekly for a predetermined number of weeks (length of test depends on application)

FIGURE 2: OVERALL SCORES FOR FRUIT PREPARATIONS AT DIFFERENT STORAGE CONDITIONS



All samples evaluated using 'Cook and Look' sensory ballot. Scores >9 deemed unacceptable. FNS3 provided comparable stability to all MFS under the three storage conditions. FNS1 and FNS2 exhibited varied performance depending on the storage condition.

Expert evaluation

Highly trained panelists evaluated all three applications using the 'Cook and Look' sensory ballot. This method uses a 15 point scale to ensure systematic, statistically significant results (with 15 being the most negative result possible), with standard references. Scores of 9 or greater are deemed unacceptable.

Novel stability solutions

Through this deep analysis, researchers obtained statistical evidence of each starch's stability in freeze/thaw, refrigerated and ambient storage conditions.

This white paper shows the results in fruit preparations as an example. Figure 1 shows the textural appeal of the samples after 12 weeks of refrigerated storage, where functional native starch 3 (FNS3) provides comparable textural stability to three traditional modified starches used as benchmarks (MFS1, MFS2, and MFS3).

Figure 2 shows the overall scores for fruit preparations under the three storage conditions. Ambient stability testing was conducted for 18 weeks, samples were stored under refrigerated conditions for 12 weeks, and frozen samples were subjected to 18 freeze/thaw cycles.

As a result of this study, the most appropriate functional native starch variety can now be more easily identified to deliver the best possible clean label solution for optimal stability across all three applications and storage conditions tested.

Further, the study's findings demonstrate that functional native starches offer similar stability to modified alternatives

in these three popular applications. Whether foods are refrigerated, ambient-stored or frozen, functional native starch can provide the stability processors need and the clean labels consumers demand.

In summary

These results provide a deeper understanding of how clean label functional native starches perform in different applications and storage conditions. The research also provided insights into the different factors that affect stability such as the type of starch, ingredient interactions, storage temperature and duration, number of freeze/thaw cycles, ice crystal formation, and excess shear.

These findings challenge conventional thinking surrounding textural stability during a products shelf life. The shelf life of a food (whether it is refrigerated, ambient-stored or frozen) may be limited by textural changes. This study revealed that formulation and processing parameters as well as the selection of the appropriate stabilizer are major factors in a product's stability, as are storage conditions. If properly formulated and processed, a food's textural stability can be maximized over the shelf life.

As a result of this research, formulators can now rely on functional native starches to deliver the same, or superior, stability as traditional modified starches, but with the added advantage of clean labeling.

Key learnings:

- There are various potential sources for texture instability, such as over processing, starch choice for storage conditions and ingredient interaction.
- Select functional native starches offer comparable stability to traditional modified starches.
- A comprehensive line of functional native starches is available to meet various application needs.

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