WHITE PAPER

Side of Apples… Hold the Sulfites

Tree Top Offers *New* Natural Preservative Option

ARTICLE SUMMARY: The industry push for clean labels shows no signs of slowing down. Indeed, its rapid acceleration is fueled by consumer demand for foods formulated with simple, more natural ingredients whenever possible. Yet at the same time, consumers want foods with a fresh appearance. This poses a challenge for formulators using apple bits, pieces and inclusions when enzymatic browning is triggered with the first cut. Tree Top, Inc. presents a clean label solution, with apple products that eliminate sulfites in favor of natural preservation methods. Get better color and all the flavor simply and naturally with Tree Top.

TREE TOP® Grower Owned Since 1960 fruit ingredients

While a rose by any other name might smell as sweet, an apple with another color — namely brown — isn't as lucky. Some consumers find discolored apples unacceptable and this can cause them to reject a product that contains brown apple bits or pieces.

Enzymatic browning is a chemical reaction triggered when an apple's cells are ruptured by biting, bruising or cutting into the apple. Polyphenol oxidase (PPO) reacts with phenolic compounds and oxygen and turns the apple's flesh brown. This not only makes the apple unattractive to consumers' eyes, but also shortens shelf life and reduces its health properties. Not only do food scientists have to be concerned with enzymatic browning, but there is also non-enzymatic browning that can lead to quality deterioration. Non-enzymatic browning is a chemical reaction involving amino acids and reducing sugars that leads to a whole range of colored compounds.

For years the industry has impeded apple browning with sulfites, which are used for color preservation, shelf life extension and antimicrobial benefits. Sulfites work well because they combat both enzymatic and non-enzymatic browning. This two-pronged attribute has made it difficult to find a clean label alternative that achieves the same effectiveness. Acidulants, typically used with salts and ascorbic acid, have been used to attempt to reduce browning. Acidulants reduce the pH and the polyphenol oxidase activity, however, they are not nearly as effective a protection against browning as other compounds.

What's Out . . . What's In

Clean label demands are growing as consumers express increased desire for foods that are "free-from" an ever-expanding list of ingredients with a push towards foods that are more natural. Mintel data tracking lists "no additives" as the top claim globally for new product introductions from 2009 to the present day. In addition to sulfites in particular and additives as a general category, consumers also want products free-from excess sugar (particularly HFCS), fat, calories, sodium, preservatives, MSG, GMOs and ingredients that could potentially trigger an allergic response.

Consumers say they prefer ingredients that are locally grown and minimally processed; easy to recognize and pronounce; and familiar because they have them at home.

Forty-eight percent of consumers say they are looking at labels to determine fruit and vegetable content, and consumers overall want to see food claims that supply both nutrition and a good or excellent source of vitamins. The preferable ingredient list is short and has descriptors that would include "clear," "transparent," "pure" and "simple." ***See fig. 1***

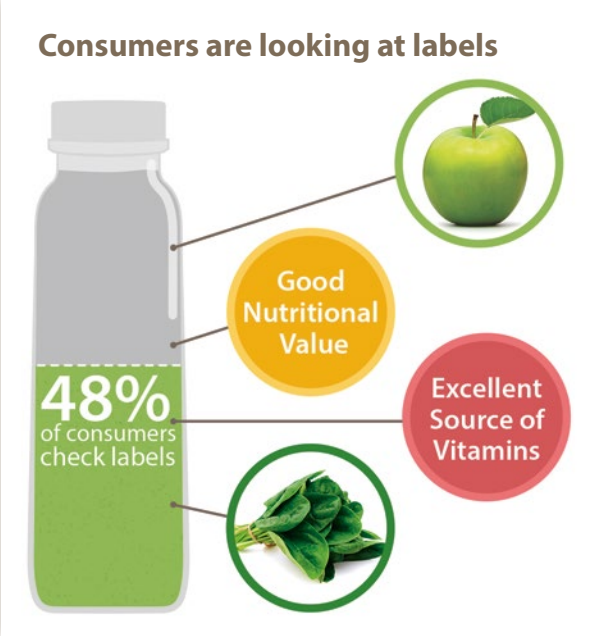

fig. 1

The difficulty is to remain clean, simple and transparent without overstating any claims, in order to avoid triggering consumer backlash. And of course, high standards for product quality, safety and appearance must be maintained. This created the need to develop a sulfite-free alternative for dried fruit, and apples in particular.

Why apples?

While exotic fruits might make headlines, all exotic fruits and berries total just five percent and three percent of domestic consumption for fruits, respectively, in whatever form. Apples are the second most common fruit consumed by Americans, according to the USDA's Economic Research Service (ERS). (Orange products have a secure first place spot primarily due to orange juice consumption at 2.8 gallons per person for 2012.)[1]

Apples often are selected as the primary fruit inclusion in products ranging from cereals to baked goods, bars and snacks like trail mixes. According to Kevin Holland, Ph.D., Product Developer at Tree Top, it is important to match the fruit ingredient to the application. "Typically, a developer will use an apple piece with the same water activity as the application, but it may be different depending on the processing. Preservatives not only retain fresh apple color, they also make it possible to create an apple inclusion that can be shelf stable at a higher water activity." ***See fig. 2***

Apples as fruit inclusions

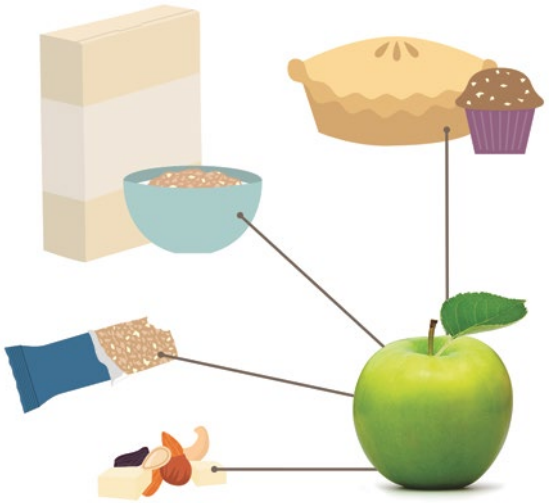

fig. 2

"The end result of course, depends on the finished application and manufacturers need to consider the final product application, processing steps and final desired water activity levels."

Holland continued, "If a formulator is going to include the apples in a baked product, we can adjust the apple pieces for a higher moisture level than in a cereal, for example. Snack bars have a wide range of moisture levels, from the more dry, grain-focused bars to something like an all-fruit bar, which would have a much higher level of moisture. We can generally tailor the ingredient to meet the end product objectives."

What are Sulfites?

For years the food industry has relied on sulfites to help preserve dried fruit, among other applications. Sulfites are salts that exist in nature and occur naturally in some foods. Man has employed some form of sulfite as a preservative or antimicrobial for centuries, with the earliest physical records from 15th century Germany, although historians suggest Greek and Roman civilizations might have utilized a form of sulfites.

Today sulfites are found in wine and are approved as regulated food additives used to preserve foods and beverages, prolong shelf life and prevent the growth of microorganisms.

The U.S. Food and Drug Administration (FDA) requires companies to declare the presence of sulfites on food labels when used as an ingredient in the food and also if used as a processing aid or when present in an ingredient used in the food, such as dried fruit pieces within a snack bar. Some companies will declare whether a product was produced within a facility that contains sulfites used on other processing lines. Companies must declare sulfite presence on product labels when the concentration is greater than or equal to 10 parts per million (ppm) total.

The Right Sulfite Alternative

Tree Top started investigating potential options for a clean label preservative agent for dried apples. In addition to clean label, it would need to meet application requirements for low water activity and provide good shelf life properties.

The Tree Top solution is a proprietary blend of sea salt, lemon juice and molasses (SLM) that meets all of the criteria. This blend provides the antimicrobial properties customers need, will not affect the flavor of the finished product and helps retain proper color. The mechanism of action has not been explored yet, but there are several ways anti-browning compounds can inhibit browning including:

- Reducing oxygen
- Reducing phenolic compound activity
- Interrupting the reaction
- Inhibiting the enzyme

Apples treated with this proprietary blend are dried to a moisture level of less than 3.5 percent.

The process provides apple ingredients with a one-year shelf life when stored at 70 F, or two years when refrigerated – providing sufficient shelf life for many applications.

The lower the water activity of the application, the longer the apples will retain their natural appearance because shelf life hinges on water activity. Temperature also plays a key role in controlling the reaction. As with most reactions, the higher the temperature, the faster the reaction will proceed.

These particular sulfite-alternative apples are best suited for low moisture applications, such as cereals, trail mixes, as a crunchy topping for yogurt, a snack bar topper or even as a stand-alone snack. For baking applications a simple rehydration process encourages the inclusion of dried apple ingredients.

In addition to an increased interest in fruits as they relate to healthy eating, Innova predicted texture as a trend to watch for 2015. It also notes a "huge increase in fruit-based snacks and fruit ingredients" in the market with fruit-based snack introductions overtaking simply fruit-flavored snacks in Europe last year.

"Apples are a great way to add sweet crunchiness to a cereal or snack," says Holland. "In addition to flavor, apples provide a great complementary texture for the oats, wheat or other grains used as the cereal base for that mixture of flavors and mouthfeel consumers enjoy."

Reduces Sodium

Sulfites, which are salt-based ingredients, add to the sodium level in dried fruit. This new sulfite-alternative blend from Tree Top helps reduce the ingredients' sodium level, cutting in half the resulting amount of sodium per fruit serving. Sulfited apples contain 52 mg sodium per fruit serving. However, the Tree Top alternative supplies a low 27 mg of sodium per fruit serving — a level lower than many other sulfite alternative preservatives. Sodium reduction helps create products that fit one of the "free-from" requirements for clean labels. ***See fig. 3***

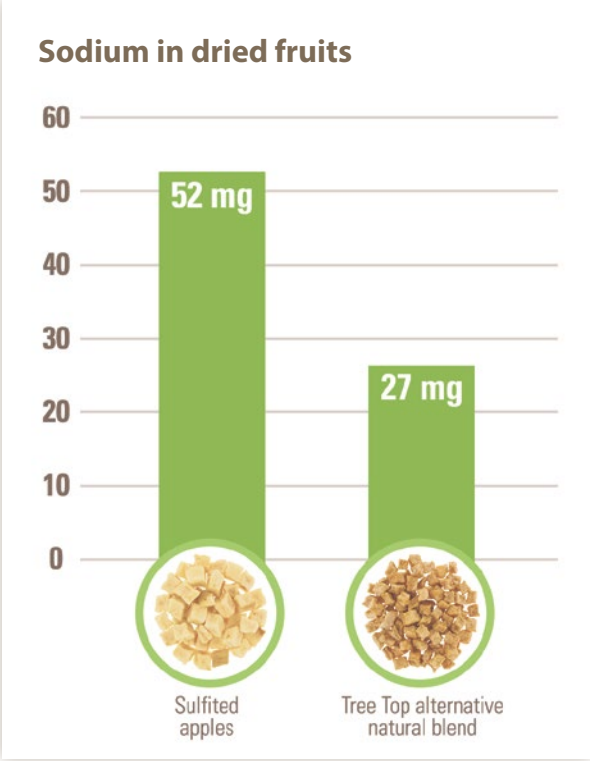

fig. 3

Sulfite Reactions

The types of sulfites allowed as food ingredients with GRAS status include sulfur dioxide (SO_2), sodium bisulfite ($NaHSO_3$), potassium bisulfite ($KHSO_3$), sodium metabisulfite ($Na_2S_2O_5$), potassium metabisulfite ($K_2S_2O_5$) and sodium sulfite (Na_2SO_3). When naturally occurring sulfites in a food — which is rare — are combined with sulfite added to a food, this contributes to the analytical result and must be declared on the food label according to FDA.

This declaration is due to the fact a segment of the population reacts in an allergic manner to sulfites within food. Sulfites are listed as one of the top 10 food allergens. FDA stepped in to regulate sulfite usage in 1986 after several patrons, primarily steroid dependent asthmatics, died after eating salad bar contents that had been treated with sulfites. Sulfite-induced asthmatic reactions are well-documented and of particular concern to at least five percent of the population diagnosed with asthma. An individual can develop sensitivity to sulfites at any age.

Despite the fact that restaurants are no longer adding sulfite to salad bar ingredients, they are used in certain foods and beverages as preservatives, such as potatoes, shrimp and even in some pharmaceuticals. Sulfites have been used in wine making for centuries and red wine contains a greater amount of sulfite than white wine. However, although some consumers fond of red wine attribute their resulting headaches to sulfite content, the average sulfite content for wine ranges between 20 to 350 ppm, while raisins and dried apricots can contain between 500 to 2,000 ppm.

The End Result

The apples treated with the new Tree Top SLM preservative provide two years of shelf life under refrigerated conditions and up to a year under dry storage at 70 F. Sorbitol content and humectancy are unaffected.

"In terms of appearance, whereas sulfite treated apples tend to turn a bit yellow, adding to an aged appearance, the dried apple ingredients, using this new sulfite-free alternative, appear whiter, fresher and cleaner than those that use sulfites," says Holland.

Tree Top staff has tested the preservative on different apple varieties, and it performs well on the most popular types used for dried apple ingredients/inclusions. In addition to snack and baked products, Holland says these dried apple bits would fit well into a crunchy yogurt topping as an add-in.

Whatever the final product, with the new Tree Top SLM dried apples, the label attribution would read, "apples, sea salt, lemon juice concentrate and molasses," compared to options which would include words like "potassium metabisulfite" or "erythorbic acid," or "calcium chloride."

"It isn't even a question of 'which would you rather see on your label?'" says Holland. "The question is which label will make your customers the most comfortable and the most likely to purchase your product?"

References

[1] USDA, Economic Research Service, "Loss-Adjusted Food Availability Data," Most commonly consumed fruits among U.S. consumers, 2012. Accessed March 13, 2015.

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Side of Apples...Hold the Sulfites

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