Formulating with Monk Fruit (Mogroside V) and Allulose

Trial design for sugar-reduced beverages, frozen desserts and bakery

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Abstract

Sugar reduction changes sweetness, dissolved solids and process behavior at the same time. Monk fruit extract can supply high-intensity sweetness, while allulose can contribute sweetness and solids and change freezing and browning. This technical note describes a controlled way to compare the two ingredients in three applications. It summarizes published research and an ideal-solution calculation. The trials below are proposed evaluation methods.

1. Compare sweetness over time in the finished beverage

Mogroside V content identifies an assay target, not a fixed sweetness multiplier. Record the assay basis, carrier, lot and preparation method for each extract. In a beverage trial, compare the current sucrose control with an allulose-only sample, an extract-only sample and a combined sample. If the objective is a sensory comparison at equal peak sweetness, calibrate the samples in a preliminary session before assigning blind codes.

Keep the base, serving temperature, pH and carbonation comparable. Record onset, peak, lingering sweetness, bitterness and astringency separately at predefined intervals. An extract-plus-allulose sample that simply tastes sweeter can appear to mask bitterness, so check the effect again at matched peak sweetness. Report any preference by matrix and lot. A reference to an HPLC grade does not establish a receptor mechanism, dose threshold or finished-product taste profile.

2. Replace freezing function separately from sweetness

In a dilute ideal aqueous solution, freezing-point depression depends on the number of dissolved solute particles per mass of solvent. D-allulose and sucrose are non-electrolytes. At equal dry mass and equal water mass, the ratio of their theoretical effects is approximately **342.30 ÷ 180.16 = 1.90**, using their molar masses in g/mol. This is a screening calculation for individual dissolved sugars. A frozen-dessert mix contains other dissolved solutes and changes concentration as ice forms, so 1.90 does not predict the final freezing curve or scooping hardness. [1]

Keep the dairy or plant base, fat, protein, stabilizer and freezer conditions fixed in the first comparison. Record gravimetric or formulation-based total solids independently from any refractometer reading, because apparent °Bx responds to the mix composition. Measure initial freezing point, draw temperature, overrun, hardness at a specified serving temperature, melt and changes after a defined storage cycle. Select the sweetness level in a separate comparison. Set energy and sugar claims from the finished formula and applicable labeling rules.

3. Measure browning, texture and water activity in bakery

Allulose is a reducing ketohexose and can participate in Maillard reactions in the presence of amino compounds. A published cupcake study observed darker color, lower water activity and differences in volume expansion and thermal setting under its specific test conditions. Cookie studies also show that the matrix changes the result. Surface color alone does not establish equivalent baking or finished-product quality. [2–3]

Keep flour, protein, dough water, piece weight and oven settings fixed in the first screen. Compare the original sucrose formula, a reduced-sucrose base and the proposed replacement. Record surface color, doneness or core temperature where applicable, mass loss, spread or volume, texture after cooling, and water activity at a controlled measurement temperature. Adjust the process once the first screen identifies which constraint changed. Establish a shelf life from finished-product validation, including the intended packaging and storage conditions.

4. Verify market access and the named manufacturer

- **United States.** FDA's allulose guidance describes enforcement discretion for excluding allulose from declared Total Sugars and Added Sugars and using **0.4 kcal/g** for label calorie calculations. Allulose remains in Total Carbohydrate. GRN 301 concerns a specified monk fruit extract and defined intended uses. Check the notice and the offered grade before relying on it. [4–5]
- **Canada.** The List of Permitted Sweeteners entry M.4 lists monk fruit extract for table-top sweeteners, with a maximum of **8,000 ppm calculated as mogroside V**. Check the applicable authority for the exact ingredient and use before assuming permission in a finished beverage, bakery product or dessert. [6]
- **European Union and Great Britain.** Certain non-selective aqueous decoctions are described in separate novel-food status determinations. Match the actual production process, composition, market and intended use to the scope. A product's °Bx does not establish regulatory eligibility or the correct ingredient declaration. [7–8]
- **Australia and New Zealand.** FSANZ assessed monk fruit extract as a food additive under A1129 and D-allulose as a novel food under A1247. Confirm the relevant food category and conditions in the current Code before use. [9–10]

For a trial, ask for the named manufacturer, grade, assay method and basis, matching batch COA, technical data sheet and relevant certificates. Hengliyuan develops and processes sweetener blends and also sources extracts from external manufacturers. Documents should match the production site and lot offered. Record the formula, ingredient batches, test conditions and acceptance criteria before scale-up.

References

1. Controlling the hardness of ice cream, gelato and similar frozen desserts — dilute-solution calculation and frozen-dessert context.
2. Effect of D-allulose, in comparison to sucrose and D-fructose, on the physical properties of cupcakes — controlled cupcake comparison.
3. Investigation of oligosaccharides and allulose as sucrose replacers in low-moisture wire-cut cookies — application-specific cookie trials.
4. FDA final guidance on the declaration of allulose and its calories.
5. FDA GRAS Notice 301.

6. Health Canada List of Permitted Sweeteners.
7. European Commission Article 4 consultation outcomes.
8. Great Britain Food Standards Agency determination for non-selective aqueous monk fruit decoctions.
9. FSANZ A1129 — Monk Fruit Extract as a Food Additive.
10. FSANZ A1247 — D-allulose as a novel food.

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