

Catherine Belisle PhD, 2023

Overview

Cornell Maple Program

> This bulletin is a subset of the Marshmallow Series, which includes Basics of Maple Marshmallows and Maple Marshmallow Spread. Please refer to the Basics of Maple Marshmallows for more information on <u>gelatin</u> <u>and sugar science</u>, <u>food additives</u>, and <u>market</u> <u>projections</u>.



Dehydrated maple marshmallows are a delicate, crunchy treat with only four ingredients – gelatin, sugar, syrup, and water. They are an ideal addition to cereal, trail mix, and hot chocolate.

The Science of Dehydrated Marshmallows

Similar to fresh marshmallows, dehydrated marshmallows contain sugar, gelatin, and water. The difference between fresh and dehydrated marshmallows is the ratio of sugars used. Dehydrated marshmallows use a **5:2 ratio** of granulated sugar to inverted sugar. In comparison, fresh maple marshmallows use a 3:2 or 1:1 ratio of these sugars.

Sucrose is the primary sugar in both maple syrup and dehydrated marshmallows. It provides sweetness and contributes to an aerated texture when whipped. Sucrose can be broken into invert sugars (**glucose** and **fructose**) when treated with the enzyme invertase or an acid, such as tartaric acid or citric acid. Invert sugars reduce crystallization and help to maintain water content in confections. In marshmallow production, the whipped sugar mixture forms a foam that is stabilized by **gelatin**, an elastic protein. The gelatin allows marshmallows to maintain a light, aerated texture; without gelatin, marshmallows would have a dense, chewy texture.

When **dehydrating**, marshmallows maintain their structure due to the matrix formed between the sugars and gelatin. To maintain quality and reduce moisture absorption, store the product in an air-tight container with a moisture barrier. When stored properly, dehydrated marshmallows can have a shelf-life of up to 1 year. Dehydrated marshmallows are a stable product and do not require a preservative, stabilizer, or other food additive.

Recipe

Dehydrated Maple Marshmallows (5:2 Ratio)

Ingredients

12 (30 g) Silver Gelatin Sheets or 2.4 (16.8 g) Knox Powdered Gelatin Packets¹

385 g Granulated Maple Sugar

245.5 g Inverted Dark Maple Syrup²

118 g (1/2 cup) Water

Pinch of salt (optional)

130 g Powdered Maple Sugar³



¹To substitute gelatin sheets with powdered gelatin, use 1 packet for every 5 gelatin sheets. Knox brand powdered gelatin has an approximate Bloom strength of 225 and contains about 7 g of gelatin per packet (Knox, n.d.).

²To fully invert maple syrup, add 1 teaspoon of invertase per gallon of syrup. For a rapid conversion, hold maple syrup with invertase at 120 - 150 °F for 24 hours. Where time is not a factor, mix the solution thoroughly and store at room temperature for 3 - 5 days.

³Instructions for Powdered Maple Sugar preparation are provided in the Basics of Maple Marshmallow.

Directions

1. Submerge gelatin sheets in cold water until softened (10 – 15 minutes).

2. While gelatin is rehydrating, use a neutral-flavored oil (vegetable, canola, corn, safflower) to lightly coat two 18" x 26" baking pans, plastic wrap to cover the marshmallows while they set, and a rubber spatula. Remove excess oil with a paper towel.

3. Squeeze rehydrated gelatin sheets to remove excess water, and place them into a double boiler. Heat on low until the gelatin is liquid (2 - 3 minutes). Take care not to overheat.

4. Transfer liquid gelatin into a stand mixer with a whisk attachment. Gelatin will gel as it cools and liquefy again as the hot syrup solution is added to the stand mixer.

5. In a medium saucepan, add the granulated maple sugar, inverted maple syrup, water, and salt. Heat to 245 °F. Immediately remove from heat and allow to cool to <200 °F.

6. Once the syrup has cooled, turn the stand mixer on low. Slowly add the cooled syrup to the gelatin by pouring it down the side of the mixing bowl.

7. Increase stand mixer speed to high and continue to mix for 10 - 12 minutes.

8. Working quickly, use the rubber spatula to deposit the marshmallow mixture into the baking pans and spread evenly. Gently cover and press the oiled plastic wrap onto the exposed surface of the marshmallow to avoid formation of a crust. Allow the marshmallows to set at room temperature for 6 - 24 hours.

9. Coat a cutting board with Powdered Maple Sugar. Use lightly oiled hands to release the edges of the marshmallow from the baking pan and place the marshmallow onto the cutting board. Using a lightly oiled knife or other cutting implement, cut the marshmallows 20 to 25% smaller than the final desired size.

10. As each marshmallow is cut, coat completely with Powdered Maple Sugar. Shake excess powdered sugar off of the marshmallows using a sifter.

11. Dehydrate marshmallows using a vertical or lateral flow dehydrator at 130 °F until marshmallows are a crisp texture throughout. Rotate marshmallows periodically to ensure evening drying.

12. Store dehydrated marshmallows in an air-tight, moisture barrier container for up to 1 year.

Recipe yields approximately 300 g or 10 – 12 cups after dehydration.

Preserving Product Quality

Regulation Requirements

Commercial production of dehydrated maple marshmallows requires a scheduled process from a Process Authority and production in a licensed kitchen inspected by the state department. In New York, this is the New York State Agriculture and Markets. For more information, please see the Basics of Maple Marshmallows bulletin and the Getting Started: Value-Added Products bulletin.

Packaging and Shipping

Store marshmallows at room temperature in an air-tight container with a moisture barrier. Moisture barrier packaging prevents moisture uptake or loss in the marshmallows. Options include linear low-density polyethylene (LLDPE), polyethylene terephthalate (PETE or PET), and glass packaging. (Fig. 1). Alternative moisture barrier packaging options are available and can be appropriate for marshmallows.



Figure 1. Packaging examples for dehydrated maple marshmallows.

Cost and Pricing

Equipment

A mixer and dehydrator are necessary to commercially produce dehydrated maple marshmallows. A stand mixer with a minimum of 575 watts is recommended. Sizes can range from a small stand mixer (6 to 8 quart) for \$400 – \$1,500 or a large stand mixer (12 to 25 quart) for \$1,000 – \$8,000.

Dehydrator sizes range from small (6.5 to 16 sq. ft. of drying space) for \$50 - \$600 to commercial grade (27.5 to 55 sq. ft) for \$900 - \$2,300. Industrial range units are also available. Selecting the appropriate machinery will depend on the amount of product being produced.

Cost of ingredients

The costs shown reflect those of the brands used in the development of this product; these ingredients were not sourced for competitive pricing.

Ingredient	Cost per 300 g batch
Silver Gelatin Sheets from PerfectaGel	\$1.77
Cornell Maple Syrup ¹	\$10.09
Invertase from LorAnn Oils	\$0.03
Salt (negligible)	\$0.00
Total cost per 300 g batch:	\$11.89

¹Includes syrup used to make granulated sugar, powdered sugar, and inverted syrup, using a wholesale price of \$50 per gallon. Does not include the cost of converting syrup to sugar.

Gourmet dehydrated marshmallows are frequently sold in 3 oz (85 g) retail units. One batch of the Dehydrated Maple Marshmallow recipe yields 3.5 retail units, at an ingredient cost of \$1.13 per ounce. This cost will decrease with bulk purchasing and sourcing for

competitive pricing. Gourmet dehydrated marshmallows in 2.5 to 3 oz packaging range from \$1.19 to \$5.00 per ounce at the time of this publication.

Consumer Evaluations

A consumer preference test was conducted to evaluate overall liking, flavor intensity, and texture attributes of dehydrated maple marshmallows. Data was collected from 100 participants during a Maple Weekend event at Shaver Hill Farm. Overall, the product was liked by 97% of consumers, with 73% of consumers liking the product very much or extremely (Fig. 2).





Figure 2. Overall liking of dehydrated maple marshmallows evaluated by consumers (n=100) at a Maple Weekend event. All participants were regular consumers of maple products.

Consumers also evaluated the intensity of maple flavor, sweetness, crunchiness, and chewiness using a Just-About-Right scale (Fig. 3). The maple flavor and sweetness were rated as "just about right" by 78% and 83% of consumers, respectively. Meanwhile, the texture characteristics, crunchiness, and chewiness were liked by 73% and 70% of consumers, respectively. A selection of consumers preferred less crunchiness (18%) and more chewiness (14%), similar to traditional marshmallow texture. Some consumers (20%) preferred more maple flavor. In the presented study, amber maple syrup was used for sugar and powdered sugar production. A darker grade of syrup for the powdered sugar may result in a marshmallow with more intense maple flavor.



Figure 3. Acceptance of flavor and texture attributes in dehydrated maple marshmallows (*n*=100).

Citations

Knox. (n.d.). Knox Basics. Knox Unflavoured Gelatine - The Basics. Retrieved March 2, 2023, from https://www.knoxgelatine.com/basics.htm

Funding for this project was made possible by a cooperative agreement from the U.S. Department of Agriculture (USDA) Agricultural Marketing Service. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA.



U.S. DEPARTMENT OF AGRICULTURE





Cornell University College of Agriculture and Life Sciences Department of Natural Resources