



INVERT SUGAR TESTING



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INVERT SUGAR TESTING

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INVERT SUGAR TESTING

PURPOSE

Sucrose is the primary sugar in maple syrup. When sucrose is broken down it forms invert sugars, glucose and fructose. The amount of invert sugar in maple syrup varies. Invert sugars tend to be in higher concentrations in syrup made toward the end of the season.

Invert sugar concentration is important to the maple confections maker and needs to be measured. The concentration of invert sugar will make a difference in the final product. Too much invert sugar could stop the product from forming the sugar crystals. Too little invert sugar could make the product "gritty". Using the correct invert sugar concentration will make the confections sweeter, softer and more resistant to spoilage.

The requirements for invert sugars and confections are;

Maple Cream – 0.5% to 3.0% with a best level of 1.5%

Maple Candy – 0.5% to 1.5% with a best level of 1.0%

Maple Sugar – 0.4% to 2%

This document describes a test to determine the invert sugar in maple syrup.

EQUIPMENT AND SUPPLIES

Glucose Meter – Accu-Chek Nano*

Accu-Chek SmartView* Test Strips

Scale – Digital Scale with a range of 0 to 300 grams with an accuracy of 0.1 grams

Dropper – Qty. 2

5 oz. Plastic Cups – Minimum 3 per test

Clean Water

* Accu-Check Nano and Accu-Chek SmartView are trademarks of ROCHE

TEST STRIP GUIDELINES:

1. ACCU-CHEK meter uses only SmartView test strips.
2. Check the date on the test strip container before you use them. If the USE BY date has passed, do not use the strips.
3. Keep unused test strips in the closed original container. Moisture can damage the test strips.
4. Use the test strip immediately after opening it (make sure the solution is already mixed).
5. Do not reuse the test strips. Use a new test strip for each test.

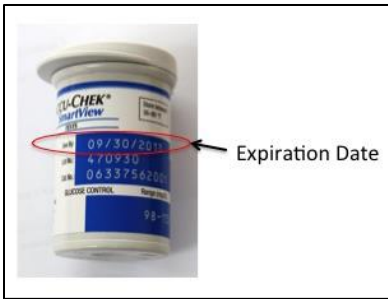
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PROCEDURE:

A blood sugar (glucose) level test meter is used to find the concentration of invert sugar in the maple syrup. The sugar concentrations in maple syrup are too high for the meter so it will need to be diluted.

1. Place a new 5oz plastic cup on the scale and zero the scale.
2. Add 10 grams of the room temperature maple syrup to be measured. To be accurate, use a dropper to add the last small amount of the weight.
3. Add 90 grams of warm water to the maple syrup. To be accurate, use a dropper to add the last small amount of weight. Either use a different dropper or thoroughly clean the dropper used to add the maple syrup. There should now be a reading of 100 grams on the scale.
4. Thoroughly mix the maple syrup and water using a clean stirrer.

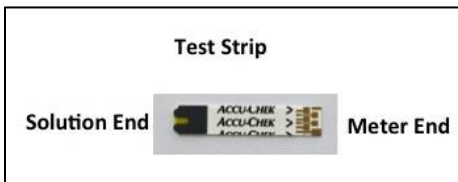
5. Check the expiration date on the test strip container. Do not use if they are expired



6. Turn on the meter and it will display a flashing test strip symbol.



7. Wash your hands and remove a test strip from the container, handling the strip only by the side edges.

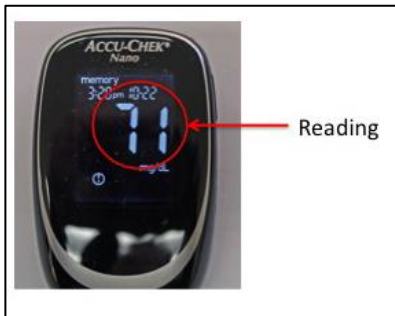


8. Insert the test strip into the meter. An hourglass symbol will be displayed for about 5 seconds. It will then change to a flashing drop symbol.



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9. Touch the end of the test strip into the solution and wait for the hourglass symbol to appear.



10. The hourglass symbol will disappear and the meter will display a number in mg/Dl (milligrams per deciliter).

NOTE: The meter has a range of 20mg/Dl to 600mg/Dl (0.4% to 12% invert sugar). If the meter cannot make a reading, try diluting the sample further and changing the meter reading multiplier (listed in the next section as 0.02). Example: Use 5 grams of maple syrup and 95 grams of water then use a multiplier of 0.04. Caution in using this method – use larger batches (200 grams or greater such as 10 grams of maple syrup and 190 grams of water) to reduce weight errors.

11. Use the table below to determine the invert sugar level. In general the invert sugar level will be the meter reading multiplied by 0.02.

METER READING (mg/DL)	INVERT SUGAR (%)
10	0.2
15	0.3
20	0.4
25	0.5
30	0.6
35	0.7
40	0.8
45	0.9
50	1.0
55	1.1
60	1.2
65	1.3
70	1.4
75	1.5
80	1.6
85	1.7
90	1.8
95	1.9
100	2.0
105	2.1
110	2.2

115	2.3
120	2.4
125	2.5
130	2.6
135	2.7
140	2.8
145	2.9
150	3.0
155	3.1
160	3.2
165	3.3
170	3.4
175	3.5
180	3.6
185	3.7
190	3.8
195	3.9
200	4.0
205	4.1
210	4.2
215	4.3
220	4.4
225	4.5
230	4.6

12. See ATTACHMENT #1 for a chart showing what concentration of invert sugar should be used for a specific product.

13. When you have completed the test, discard the syrup mixing cup and the test strip. Wipe off the meter and store safely.

INVERT SUGAR TESTING

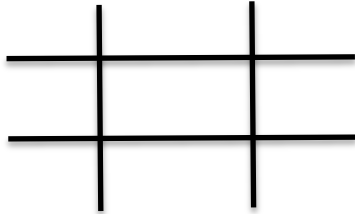
ADJUSTING INVERT SUGAR LEVEL

Adjusting Low Invert Sugar Level Syrup with High Invert Sugar Level Syrup

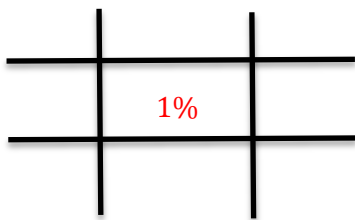
NOTE: Refer to your State regulations as to the allowable methods of changing invert sugar levels.

To adjust a low invert sugar level in syrup, blend with syrup that has higher invert sugar level. The following method called *alligation* is used to determine how to blend syrups. This method will not work if you are using water or maple sap to adjust the syrup. NOTE: Make sure the higher invert sugar syrup has an acceptable flavor.

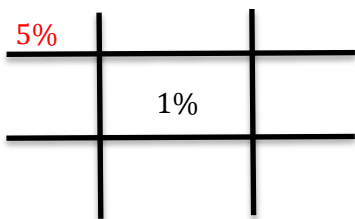
Draw a grid as follows:



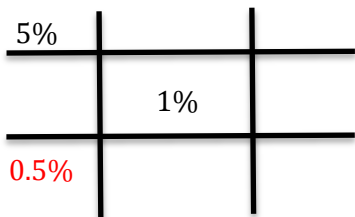
Into the center of grid write the percentage of the invert sugar needed ex. 1% for candy:



In the top left corner of the grid write invert sugar percentage of the maple syrup being added to the lower concentration maple syrup:

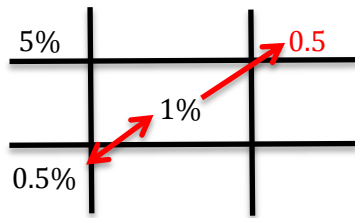


In the bottom left corner of the grid write in the percentage of the lower concentration maple syrup:

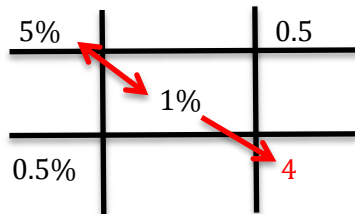


Calculate the top right corner by subtracting on a diagonal from bottom left to center. Always subtract the smaller number from the larger number then write the result in the top right corner:

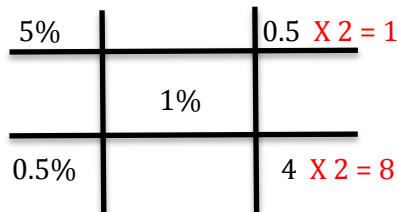
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Calculate the bottom right corner by subtracting on a diagonal from top right to center. Always subtract the smaller number from the larger number then write the result in the bottom right corner:



To make it easier to use the results of the table, multiply the numbers to make the decimal number a whole number (in this example multiply by two):

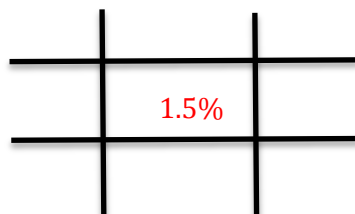


This result means to have a maple syrup for candy, blend 1 part of 5% to 8 parts of 0.5%.

EXAMPLE:

You have 1 gallon of maple syrup you want to use for making maple cream. The invert sugar test indicated the level to be 0.3%. You also have a gallon of maple syrup that has tested 4% for invert sugar. You need to know how to blend the two syrups in order to have 1 gallon of 1.5% invert sugar for a batch of maple cream.

Into the center of grid write the percentage of the invert sugar needed (1.5%):



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In the top left corner of the grid write in the percentage of the invert sugar for the maple syrup used to raise the percentage of the low invert sugar maple syrup (4%):

4%			
		1.5%	

In the bottom left corner of the grid write in the percentage of the low invert sugar maple syrup (0.3%):

4%			
		1.5%	
0.3%			

Calculate the top right corner by subtracting on a diagonal from bottom left to center. Always subtract the smaller number from the larger number then write the result in the top right corner:

4%			1.2
		1.5%	
0.3%			

Calculate the bottom right corner by subtracting on a diagonal from top right to center. Always subtract the smaller number from the larger number then write the result in the bottom right corner:

4%			1.2
		1.5%	
0.3%			2.5

To make it easier to use the results of the table, multiply the numbers to make the decimal number a whole number (in this example multiply by ten):

4%			1.2 X 10 = 12
		1.5%	
0.3%			2.5 X 10 = 25

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This result means to have a maple syrup for candy, blend 12 parts of 4% to 25 parts of 0.3%. To adjust this number for a gallon, use volumes (128 ounces per gallon).

Total parts of solution from the calculations is $12 + 25 = 37$.

To find the number of ounces per part: $128 \text{ oz.} \div 37 \text{ parts} = 3.46 \text{ oz/part}$

To find the number of ounces of the 0.3%: $25 \text{ parts} \times 3.46 \text{ oz/part} = 86.5 \text{ ounces}$

To find the number of ounces of the 4%: $12 \text{ parts} \times 3.46 \text{ oz/part} = 41.5 \text{ ounces}$

So blend 86.5 ounces of the low invert sugar syrup (0.3%) with 41.5 ounces of the higher invert sugar syrup (4%).

FEEDBACK

Please use the following e-mail address (feedback@leaderevaporator.com) to suggest improvements or enter comments on this document. Reference the document title in your note. You may also contact LEADER Customer Service.

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ATTACHMENT #1: INVERT SUGAR% REFERENCE CHART (90/10 water/syrup)

METER READING (mg/DL)	INVERT SUGAR (%)	Use for Cream	Use for Candy	Use for Sugar
10	0.2	NO	NO	NO
15	0.3	NO	NO	NO
20	0.4	NO	NO	Yes
25	0.5	Yes	Yes	Yes
30	0.6	Yes	Yes	Yes
35	0.7	Yes	Yes	Yes
40	0.8	Yes	Yes	Yes
45	0.9	Yes	Yes	Yes
50	1.0	Yes	BEST	Yes
55	1.1	Yes	Yes	Yes
60	1.2	Yes	Yes	Yes
65	1.3	Yes	Yes	Yes
70	1.4	Yes	Yes	Yes
75	1.5	BEST	Yes	Yes
80	1.6	Yes	NO	Yes
85	1.7	Yes	NO	Yes
90	1.8	Yes	NO	Yes
95	1.9	Yes	NO	Yes
100	2.0	Yes	NO	Yes
105	2.1	Yes	NO	NO
110	2.2	Yes	NO	NO
115	2.3	Yes	NO	NO
120	2.4	Yes	NO	NO
125	2.5	Yes	NO	NO
130	2.6	Yes	NO	NO
135	2.7	Yes	NO	NO
140	2.8	Yes	NO	NO
145	2.9	Yes	NO	NO
150	3.0	Yes	NO	NO
155	3.1	NO	NO	NO
160	3.2	NO	NO	NO
165	3.3	NO	NO	NO
170	3.4	NO	NO	NO
175	3.5	NO	NO	NO
180	3.6	NO	NO	NO
185	3.7	NO	NO	NO
190	3.8	NO	NO	NO
195	3.9	NO	NO	NO
200	4.0	NO	NO	NO

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Adapted from information presented in:

Cornell Maple Bulletin 206 (2007) "Measuring and Adjusting Invert Sugar in Maple Sugar" by Stephen Childs and Brian Chabot

Cornell Maple Bulletin 201 (2007) "Making Maple Cream" by Stephen Childs

Cornell Maple Bulletin 208 (2007) "Molded Sugar Candy (Soft Sugar Candy)" by Stephen Childs

Cornell Maple Bulletin 207 (2007) "Granulate Maple Sugar" by Stephen Childs

North American Maple Syrup Producer's Manual, Second Edition Produced by Ohio State University Extension 2006