

## CARBOHYDRATE FUNCTIONALITY-SWEETNEERS

### Three Experiments

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#### Experiment 1: Freezing point depression.

##### Materials:

- a) Solution containing 360 g dextrose/1000 g water
- b) Solution containing 360 g sucrose/1000 g water
- c) Solution containing 360 g High Fructose Corn Sweetener (solids)/1000 g water. HFCS is typically 70% solids. If you can not locate any HFCS, you can make by combining 42% fructose and 58% glucose.

A portion of each solution should be frozen into cubes prior to the start of the laboratory.

##### Procedure:

For each solution, add enough liquid solution to a 250 ml beaker to cover 3-4 cubes of the corresponding frozen solution. Stir with a stirring rod, and add more cubes if necessary so that some frozen solution is continually present. Record the temperature of the contents of the beaker every two minutes until the temperature reaches equilibrium (three consecutive readings with no temperature change). The equilibrium temperature represents the freezing point for that solution. Compare the freezing points for the three treatments.

#### Experiment 2: Maillard browning reaction.

##### Materials:

5% w/v solutions of the following:

<u>Sugar</u>	<u>Amino Acid</u>
Fructose	Lysine
Galactose	Methionine
Glucose	Serine
Maltose	Valine
Sucrose	

**Procedure:**

1. Combine 3 mL of each sugar solution with 3 mL of each amino acid solution, in screw cap test tubes. Twenty different sugar/amino acid combinations are possible.
2. Cap the tubes loosely.
3. Autoclave at 121° C for 60 min.
4. Remove tubes and allow cooling before handling.
5. Describe the aromas produced and the degree of browning for each solution. Record the color as 0 = none, 1 = light yellow, 2 = deep yellow, and 3 = brown.

**Experiment 3: Effect of high fructose corn sweetener on cookies.**

Formula (AACC Method 10-50D):

**Materials:**

<u>Ingredients</u>	<u>Weight (g)</u>
Shortening	64.0
Sugar	130.0 (or 97.5 g sucrose + 43 g high fructose corn sweetener)
Salt	2.1
Sodium bicarbonate	2.5
Dextrose solution*	33.0
Distilled water	16.0 (or 5.0 ml water when substituting HFCS)
Flour	225.0

\*8.9 g dextrose hydrous in 150 ml water

In the second treatment, 25% of the sucrose will be replaced with an equivalent solids weight of high fructose corn sweetener. Water will be reduced accordingly.

**Procedure:**

- 1) Cream shortening, sugar, salt, and sodium bicarbonate in mixer with flat beater, using low speed for 3 min. Scrape down after each minute.
- 2) Add dextrose solution, and distilled water. Mix 1 min at low speed. Scrape. Mix 1 min. at medium speed. Add all the flour and mix 2 min at low speed, scraping down after each ½ min.
- 3) Place six portions of dough at well-spaced points on a cookie sheet. Flatten each dough slightly, and then roll to proper thickness using rolling pin and gauge strips. Cut cookies on sheet, lifting scrap dough up from around cutter and discarding.
- 4) Bake cookies at 400° F for 10 min.

- 5) On removal from oven, transfer cookies to absorbent paper using a spatula.  
Allow cookies to cool.
- 6) Compare the color, surface appearance, and texture of the cookies with and without HFCS.

Equipment and reagents can be obtained from the following sources:

Fisher Scientific  
1-800-766-7000 (phone)  
1-800-926-1166 (FAX)  
[www.fishersci.com](http://www.fishersci.com)

VWR Scientific Products  
1-800-932-5000  
[www.vwrsp.com](http://www.vwrsp.com)

Cole-Palmer Instrument Company  
1-800-323-4340 (phone)  
[www.colepalmer.com](http://www.colepalmer.com)

Sigma Chemical  
1-800-325-3010 (phone)  
1-800-325-5832 (FAX)  
[www.sigma-aldrich.com](http://www.sigma-aldrich.com)

If you have difficulty locating any item, please feel free to contact me:

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