Taste Test

An Enzyme Demonstration

Introduction

Students are prohibited from tasting or eating in the laboratory for good reason. This teacher-led "taste test" can be one exception to the rule. The taste-test demonstration is a good introductory-level activity to illustrate the role of enzymes in digestion and metabolism.

Biological Concepts

- Enzymes
- Catalysis
- Disaccharide
- Monosaccharide

Materials

Milk, 2%, one quart for each eight tasters

Lactaid® (liquid form), seven drops per eight tasters, or Lactaid caplet (dissolve the caplet in 1–2 mL of apple juice and 25 mL of water)

Clean, disposable cups (enough for each taster)

New, Beral-type disposable pipets that have never been used in the lab (enough for each taster)

Safety Precautions

Be sure to use fresh milk and dispense the Lactaid in a clean, sterile manner. Use only clean, disposable cups for the taste test. Some students who are lactose-intolerent may also be allergic to milk and should not taste milk under any circumstances, even if it has been treated with Lactaid. Do not store chemicals and food in the same refrigerator. Use only new, never-before-used pipets.

Procedure

1. Obtain fresh milk. (2% milk gives the best overall results for this taste test.) You will need about one quart of milk for every eight tasters.
2. Obtain Lactaid in liquid form (or dissolve a Lactaid caplet in 1–2 mL of apple juice and 25 mL of water). Lactaid is available at most pharmacies.
3. Taste a drop of the Lactaid solution and ask several students to taste it. Use clean pipets that have never been used in the laboratory before for each taster. Have each taster describe the "tasteless" Lactaid.
4. Set aside half of the milk as a control.
5. Add Lactaid (7 drops per quart) to the "treated half" of the milk. Shake the containers and store both the "treated" and "untreated" milk in the refrigerator for 1–2 days.
6. Using clean cups for all tasters, carefully taste each sample of milk. Have students share their taste observations. The Lactaid-treated milk should be noticeably sweeter in taste.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The treated and untreated milk may be diluted with water and flushed down the drain with plenty of water according to Flinn Suggested Disposal Method #26b. Used cups should be disposed of in the trash.

Tips

- If clean refrigerator space is a problem, enlist the help of your cafeteria personnel to use their facilities. The food service area in your school is also likely to have a supply of clean, disposable cups.

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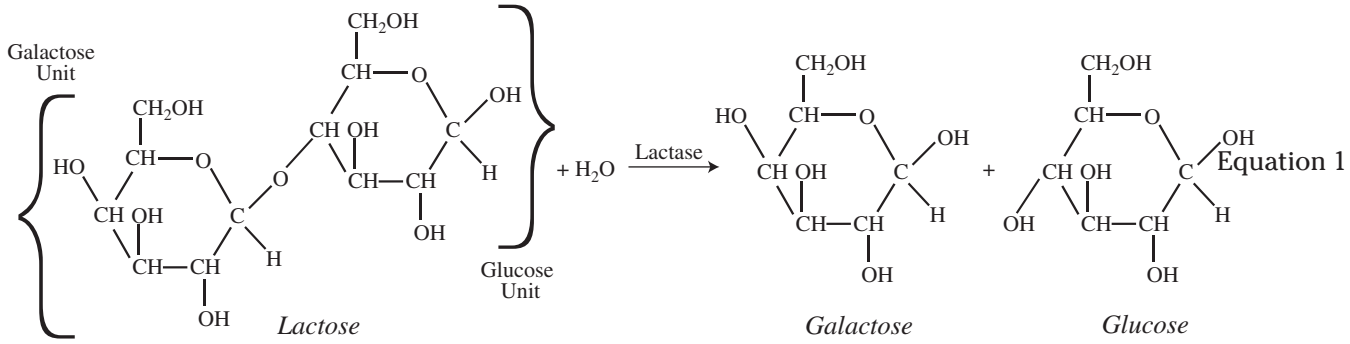
- Have volunteers conduct a blind taste test to see if they can distinguish between "treated" and "untreated" milk.
- Different types of milk (fat free, 1%, 2%, whole, etc.) will taste different to different people. Does the type of milk normally consumed affect the taste results in this experiment? Is the lactose content the same in all types of milk? How might different milks affect Lactaid experiments?

Discussion

Enzymes are specialized proteins that serve as catalysts to lower the activation energies required to make cellular reactions occur. In catalyzing these reactions, enzymes greatly speed up chemical reactions that would otherwise occur too slowly to sustain life. Because enzymes catalyze very specific reactions, all cells must contain many different enzymes to catalyze the myriad biochemical reactions that take place in a cell. If certain enzymes are not available or not produced, the consequences can be severe for the cell and the organism.

The enzyme used in this demonstration is β-galactosidase, otherwise known as lactase. Lactase catalyzes the hydrolysis of lactose (a disaccharide) into two "simple sugars" or monosaccharides, galactose and glucose, as shown in Equation 1.



The disaccharide lactose is the major carbohydrate in the milk of most mammals. It makes up about 4.5% of cow's milk. The enzyme lactase is produced in the small intestine where lactose is digested into its sugar components, galactose and glucose. If a person does not produce the enzyme lactase, the lactose cannot be digested and a syndrome referred to as lactose intolerance results. Various strategies are available to help individuals who are lactose intolerant. One of the strategies involves the use of an over-the-counter product called Lactaid®, which contains lactase derived from a fungus. Milk treated with Lactaid tastes sweet due to the production of the two simple sugars from the breakdown of lactose.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Evidence, models, and explanation

Content Standards: Grades 5–8
Content Standard C: Life Science, structure and function in living systems
Content Standard F: Science in Personal and Social Perspectives; personal health

Content Standards: Grades 9–12
Content Standard C: Life Science; matter, energy, and organization in living systems
Content Standard F: Science in Personal and Social Perspectives; personal and community health

Reference

Richman, R. M.; Villaescusa, W. *J. Chem Ed.* **1998,** *75*, 315.

Materials for *Taste Test* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP5442	Cups, polypropylene, pkg/100
AP1718	Pipets, Beral-type, pkg/20

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.