

Moving Milk through the Dairy Plant

Activity Synopsis

This activity discusses milk processing. Students learn about pasteurization, homogenization and fortification, and steps taken by the dairy plant to ensure the wholesomeness of milk.

Activity Outcomes

Students will be able to:

- List and explain three steps that occur during the processing of milk.
- Describe three safeguards for keeping milk fresh and clean.
- Identify pasteurization as a processing method used to preserve milk's quality.

Cross-curricular Outcomes

- Explain the journey of milk from production to the consumer. (Environment and Ecology)
- Define, and correctly use, terms related to dairy processing. (Language Arts)
- Communicate acquired information in a non-print format, such as a diagram or illustration. (Language Arts)
- Answer questions based on observation, inference, prior knowledge or experience. (Language Arts)

Activity Length

45 minutes

Advance Preparation

- Preview the suggested instructional strategy.
- Draw the illustrations shown below on the board or on a flip chart.

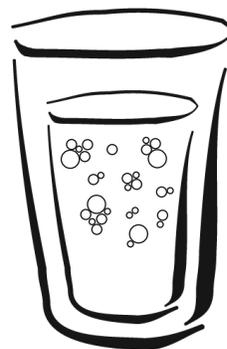
After you've completed this lesson

go to www.dairyspot.com and

- Complete our **User Survey** with your thoughts on this lesson and the entire program.
- **Enter your school librarian or media specialist** into our drawing for a chance to win a book bag, filled with dairy and nutrition-related books, for your school library!



Raw Milk



Cold, raw milk
after one hour



Homogenized milk
during storage

MILK:
It Does a
Student
Body Good!

Moving Milk through the Dairy Plant

1. Review briefly with students how cows are milked and how milk is stored until it is picked up by the tank truck driver.

2. Tell students:

■ Our next stop on milk's journey is the dairy plant. The tank truck driver delivers the **raw** milk to the dairy plant for processing.

■ Raw milk is first tested for safety.

- Milk samples taken at the farm by the tank truck driver go to the lab for more testing.
- A lab technician tests the milk to make sure it is fresh, clean and wholesome.
- One sample is immediately checked for temperature. If the temperature of the milk is above 40°F, the entire load is discarded.
- Another sample is tested for bacteria and antibiotics. In the rare event that the tanker of milk tests positive, the entire load is discarded.
- Milk is never unloaded until it passes all tests.
- The technician also tests the **butterfat** content. Butterfat is also called cream.

■ Dairy plant workers are very careful to make sure only the highest quality milk is processed for people to drink.

■ When milk passes "inspection," processing begins.

3. Explain that:

■ Once the tank truck driver gets the okay from the lab, the pumping begins.

■ Milk is pumped into large, refrigerated storage tanks or silos.

■ One of the first stops is the **separator**. *Ask students to describe what they think a separator does.* **Accept all reasonable answers.**

Explain that:

■ A separator is a machine that separates the butterfat from the raw milk. *What do we call milk that has the butterfat removed?*

Nonfat milk or skim milk

■ Some of the milk remains nonfat milk. Some nonfat milk will have butterfat added back to make other types of milk. *What are some other kinds of milk that contain butterfat?*

Lowfat (1%) milk, reduced fat (2%) milk, and whole milk

■ The remaining butterfat is pumped to other tanks and is used to make ice cream and other dairy products.

■ Some of the milk is pumped to mixing tanks. Here other ingre-

dients are added to make flavored milk. *Ask students:*

- *What flavors of milk are served in the cafeteria?*

Accept all reasonable answers.

4. Write the word "microorganism" on the board.
Ask students:

■ *Can anyone tell me what "micro" means?* **Very small**

■ *What is an organism?* **A living being**

Explain that:

■ A microorganism is a living being that is so small that you need a special microscope to see it.

Write the word "pasteurized" on the board.

Ask students:

■ *Has anyone ever heard or seen the word "pasteurized" before? Where? What do you think "pasteurized" means?*

Tell students:

■ In 1856, a French scientist named **Louis Pasteur** discovered that heating liquids to high temperatures kills microorganisms.

■ Using heat to kill microorganisms is called **pasteurization**, after Pasteur.

- Pasteurization is an example of an **eponym**.

- Eponyms are words that come from the names of people.

Explain that:

■ Bacteria are one type of microorganism.

■ While most bacteria are harmless, some could make you sick.

■ Pasteurizing milk solves two important problems.

- It kills bacteria that make milk go sour.
- It makes milk safe to drink by killing harmful bacteria that can make you sick.

■ Pasteurization protects the flavor and purity of milk.

Explain that raw milk is pumped into a pasteurizer.

■ A pasteurizer is a machine that heats, holds and chills milk.

■ In the pasteurizer, the raw milk is heated to 161°F for at least 15 seconds.

■ Then the hot milk is cooled quickly to 38 to 40°F in another section of the pasteurizer.

Ask students:

■ *Why is the milk heated?* **To kill bacteria**

■ *Why is the milk cooled after it's heated?* **To keep it fresh**

■ *What do we call the raw milk after it is heated and cooled in the pasteurizer?* **Pasteurized milk**

5. Tell students that it took a while for dairy plants to pasteurize milk.

■ A few dairies started to pasteurize milk in 1895 when commercial pasteurizing machines were invented.

■ Today, the milk we buy at the grocery store or drink at school is pasteurized.

Ask students:

■ *Do you think pasteurization was an important advance in food preservation? Yes Why? It made milk safer to drink and longer lasting.*

■ *What other invention did people need to keep milk fresh and safe? Ice box, refrigerator*

6. Write the word “homogenized” on the board.

Ask students:

■ *Has anyone ever heard or seen the word “homogenized” before? Where?*

■ *What do you think “homogenized” means?*

■ Point out that most milk in the United States is homogenized. (Refer to the drawings of butterfat globules in raw and homogenized milk to show students the difference between raw and homogenized milk.)

■ A homogenizer is a special machine used to homogenize milk.

- Milk is forced through very small holes under great pressure.
- This breaks the butterfat particles into tiny, uniform pieces.
- A protein coat surrounds each butterfat piece. This keeps the butterfat from clumping back together.
- Homogenization is an example of an **emulsion***.

■ Homogenization keeps the butterfat evenly distributed throughout the milk. As a result, the milk is smooth and creamy.

■ If milk wasn't homogenized, the butterfat would rise to the top, and you would have to shake or stir the milk before you drank it.

* Milk is an oil-in-water emulsion.

Fat globules are dispersed in the skim milk.

7. Write the word “fortified” on the board. Explain that milk is fortified with vitamins. Ask students:

■ *What does fortify mean?*

To strengthen, to add something to make it better

■ *Why is milk fortified? To make it even more nutritious*

■ *What vitamins are added to milk? Vitamins A and D*

Explain that:

■ Vitamin D is added to all types of milk, from whole to nonfat.

■ Vitamin A is added to milk that has some or all of the butterfat removed.

Ask students:

■ *What kinds of milk are fortified with vitamin A?*

Reduced fat (2%), lowfat (1%) and nonfat

8. Explain that the last step is packaging.

■ Automated machines apply labels to the plastic jugs. There is also an area where paper cartons are folded and readied for filling.

■ Important information is also added to each jug or carton. This information includes the freshness date.

■ Milk moves through pipes to the **automated milk filler machines**. These machines fill the jugs and cartons. The machines also put caps on the jugs and seal the cartons.

■ From here, the milk containers are packed into crates and stored in a cold room before being put on refrigerated trucks for delivery to stores or schools.

■ It takes about two days from the time milk leaves the cow until the time it reaches the grocery store. And during this time milk is never touched by human hands.

Check for Understanding

Have students work in small groups to create a flow chart to show the sequence of milk processing. Include a short description of each step. Include steps such as delivery to the dairy plant, storage tanks, separation, pasteurization, homogenization, fortification, packaging, storage, and delivery to store or school.

Going Further:

Solutions, Suspensions and Emulsions Use the following examples to illustrate the scientific concepts of a solution, suspension and emulsion.

■ For a solution, stir a teaspoon of sugar into a glass of water. When the water is clear, the result is a solution. The water is sweet, even though you can't see the sugar. Explain that molecules of lactose (milk sugar) are dissolved in milk the same way that the sugar is dissolved in water.

■ Make a suspension by mixing chocolate powder in a glass of milk. The chocolate powder is suspended in the milk, but if the milk sits for awhile, the chocolate particles will

come out. Pour the chocolate milk through a coffee filter. *What happens? What would happen if you did the same thing to the sugar water?*

■ An example of an oil-in-water emulsion is oil and vinegar. Pour vegetable oil and vinegar in a jar with a tight-fitting lid. Use 4 parts oil to 1 part vinegar. *Can you tell which is the oil and which is the vinegar?* When you shake the jar, you have an emulsion. Emulsions separate. Emulsifying agents are often used to make an emulsion stay mixed. Casein, a milk protein, is the emulsifying agent in homogenized milk. Casein helps the milk fat stay suspended by coating the butterfat globules.

Adapted from ***The Amazing Milk Book***
by Catherine Ross and Susan Wallace