RAFT IDEAS

Topics: Mixtures, Biochemistry, Properties

Materials List

- ✓ Whole milk, 200 mL (~7 oz)
- ✓ Lemon juice, 15mL (1 Tablespoon)
- ✓ Basket-style coffee filter
- ✓ Cup or glass (2)
- ✓ Rubber band
- ✓ Craft stick
- ✓ Wheat bread, crackers, or bagels
- ✓ Optional: salt, herbs

This activity can be used to teach:
Next Generation Science Standards:

- Molecules (Middle School, Physical Science 1-1)
- Structure of matter (Grade 5, Physical Science 1-1)
- Changes of state (Middle School, Physical Science 1-4)
- Chemical reactions (Middle School, Physical Science 1-2)

National Curriculum for Social Studies:

- Knowledge and understanding of the past (Theme 2, Time, Continuity, and Change)

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Cheese, Please

The Chemistry of Coagulation

The necessity for food preservation was just the beginning for this dairy staple.

To Do and Notice

1. Warm milk to about 74°C (165°F). A microwave can be used for this step.
2. Mix in lemon juice. Notice the coagulated globules (curds) forming in the milk. Leave the mixture to set for 10 minutes.
3. Create a basket-style drainage system for the cheese. Place the coffee filter into a cup or glass, pull the top edges of the coffee filter over the top of the cup, overhanging about 5 cm (2”), and secure with the rubber band.
4. Slowly pour the lemon cheese mixture into the coffee filter and allow the watery liquid (whey) to drain into the glass for 20 minutes. (Note: Whey has many uses, including in bread dough and as a plant food.)
5. Once drained, add salt or herbs as desired, spread cheese onto bagels, bread, or crackers and enjoy. Lemon cheese has a delicate, sweet flavor with a slight lemon taste. Cheese can be stored in the refrigerator for up to 1 week.

The Science Behind the Activity

People have preserved milk by making cheese for 1000’s of years. Probably discovered accidentally many times in many places by herders carrying milk in sacks containing a coagulating enzyme called rennet. There are 1000s of varieties of cheese, made from the milk of many different animals, including goats, sheep, yak, and cows. Cheese can be thought of as solid milk. Milk is mostly water, about 87%; it also contains dissolved protein, fat, sugar (lactose), and some vitamins and minerals. Cheese making involves the coagulation of milk protein (casein) and removal of some of the watery remains (whey). Milk proteins are folded together into spheres (micelles). The lemon cheese-making process chemically changes the casein in the milk. Addition of acid causes the protein spheres to partially unfold and link together, forming a gel that traps other milk ingredients, including some water and fat. Fresh cheeses (e.g. - lemon cheese, cottage cheese) do not keep as long as aged or ripened cheeses (e.g. – Cheddar, Swiss), but they are faster and easier to make.

Taking it Further

- Dairy products offer a wide variety of possible biochemistry explorations. See the RAFT Idea Sheet ***Shake Your Butter*** for quick instructions.
- Chemically, the formation of gel by cross-linked proteins can be compared to the polymerization process that occurs in borax-glue “gak”. See the RAFT Idea Sheet ***Gackety Gak*** for more information.

Web Resources (Visit www.raft.net/raft-idea?isid=33 for more resources!)

- For cheese making supplies and recipes, visit: www.cheesemaking.com
- History of dairy farming and cheese - archaeology.about.com/od/historyofagriculture/qt/Dairy-Farming.htm & www.idfa.org/news-views/media-kits/cheese/history-of-cheese

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