From Wheat To Bread

LESSON PLAN

Grade: Five
Subject: Science
Unit: Properties of and Changes in Substances

SLO

5-2-14 - Research and describe how raw materials are transformed into useful products.

Examples: food processing, oil refining, paper milling, plastic moulding, gold smelting.

MATERIALS

Copies of the CWB brochure 'From Wheat to Bread' in Appendix 1 (print on legal sized paper).

METHOD

The jigsaw method would work well with this lesson on how wheat grain is transformed into bread.

1. First divide your students into groups of four. These will be the home groups.
2. Make enough photocopies of the CWB brochure 'From Wheat to Bread' in Appendix 1 so you have one per group.
3. Cut each brochure into four parts.

   Part One: The opening paragraph under Flour Milling plus the Wheat Kernel Cross-section, Wheat Kernel including Endosperm, Bran and Germ

   Part Two: Wheat Intake, Cleaning & Tempering, The Milling Process, Flours, Flour Treatment and By-Products

   Part Three: The opening paragraph under Bread Baking plus Four Basic Bread Types including Pan Breads, Hearth, Breads, Flat Breads and Steamed Breads

   Part Four: Methods & Ingredients, Mixing, Fermentation, Make-up, Final Proof and Baking
4. Number the students in each home group from one to four. Rearrange students into 'expert groups' by putting all of the number one students in expert group one, number two students in expert group two and so on.
5. Each expert group learns the part of the brochure that corresponds to their number and decides how best to teach the information to their home group.
6. Then the students return to their home groups and each in turn teach the others what they have learned.

ASSESSMENT

You can assess students individually by using any of the following:

- The quiz found below.
- Have each student or student group create a poster or flow chart showing how grain becomes bread.
- Have each student write from the perspective of being a wheat grain going on a journey to become bread. They should include a description of themselves, their journey through the flour mill and then the bakery. They can also describe what kind of bread they became and who ate them.

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COMPLEMENTARY ACTIVITY

AITC Bread in a Bag & Butter in a Jar at bottom of lesson plan.

This activity lends itself to demonstrating the following SLOs:

5-2-03	Investigate to determine how characteristics and properties of substances may change when they interact with one other. ***Examples: baking soda in vinegar produces a gas; adding flour to water produces a sticky paste.***
5-2-09	Explore to identify reversible and non-reversible changes that can be made to substances. ***Examples: reversible - folding paper, mixing baking soda and marbles; non-reversible - cutting paper, mixing baking soda and vinegar***.
5-2-10	Recognize that a physical change alters the characteristics of a substance without producing a new substance, and that a chemical change produces a new substance with distinct characteristics and properties.
5-2-11	Observe examples of changes in substances, classify them as physical or chemical changes, and justify the designation. ***Examples: physical - bending a nail, chopping wood, chewing food; chemical - rusting of a nail, burning wood, cooking food.***

SUPPLEMENTARY MATERIALS

How it's Made – Bread with host Mark Tewksbury, 6:22 video, http://www.youtube.com/watch?v=3UjUWfwWAC4

If you would prefer to have some or all of your students research how pasta is made you will find the CWB 'From Durum to Pasta' brochure in ***Appendix 1.***

How it's Made – Pasta with host Mark Tewksbury, 5:30 video, https://www.youtube.com/watch?v=ehzpBEKtJFY

HOW IT'S MADE:
From Wheat to Bread

Name: _____

1. Name the Canadian wheat that is considered the best for bread production.

   _____

2. The wheat kernel is a storehouse of nutrients. It is made of three parts:

   A. Endosperm
   B. Bran
   C. Germ

Match the correct part to each of the statements below:

____ i. Is the sprouting part of the seed

____ ii. Makes up to 83 per cent of the wheat kernel

____ iii. Is sold as a nutritional supplement for humans and animals

____ iv. Is added in the milling process to make whole wheat flour

____ v. Is used to make white flour

____ vi. Is used in animal and poultry feed

____ vii. Is composed of starch and protein

3. The flour milling process changes wheat into flour. It involves **five steps.** Describe what is happening at each step.

a) **Wheat Intake** - _____

_____

_____

_____

b) **Cleaning and Tempering** - _____

_____

_____

_____

c) **Milling** - _____

_____

_____

_____

d) **Flours** - _____

_____

_____

_____

e) **Flour Treatment** - _____

_____

_____

_____

4. In agriculture, very little is wasted. What is done with the germ, bran, and endosperm left over after the flour has been milled?

   _____

   _____

5. Wheat flour is unique because when you add water to the protein in the flour, gluten forms. What does gluten do to the bread dough?

   _____

   _____

6. Name the flour basic bread types.

   _____ _____

   _____ _____

7. Which type of bread is common in the Middle East and India?

   _____

8. **Order these steps in the baking process.** Put number one by the first step, number two by the second step. Continue until you have numbered in the correct order all of the steps.

   ____ a) Yeast feed on sugars and produce carbon dioxide which expands the volume of the dough.

   ____ b) The bulk dough is divided into pieces of the correct weight.

   ____ c) Flour, water, yeast and other ingredients are mixed to form dough.

   ____ d) The dough is placed in a fermentation cabinet to increase volume.

   ____ e) The dough is baked in an oven and transformed into bread.

HOW IT'S MADE: From Wheat to Bread

ANSWER KEY

1. Canada Western Red Spring wheat

2. Matching
   - C i)
   - A ii)
   - C iii)
   - B iv)
   - A v)
   - B vi)
   - A vii)

3. Steps for milling flour:

   a) Wheat Intake – wheat is weighed sampled, cleaned, sorted and stored.

   b) Cleaning & Tempering – wheat is cleaned using machines and then water is added to temper the outer bran coat in preparation for grinding.

   c) Milling – rollers separate the endosperm and grind it into flour. Sifters separate the different sized ground particles.

   d) Flours – different flour particles are combined to make different types of flour.

   e) Flour Treatment – Flour may be bleached or enriched with vitamins and mineral

4. Germ, bran and unrecoverable endosperm are sold as by-products, usually for animal feed.

5. Gluten creates an elastic dough capable of holding gas.

6. Four types of bread – Pan Breads, Hearth Breads, Flat Breads, Steamed Breads

7. Flat breads are common in the Middle East and India.

8. Baking Process

   2 a)

   3 b)

   1 c)

   4 d)

   5 e)

The Canadian Wheat Board

From Wheat to Bread

FLOUR MILLING

Flour is produced by separating the endosperm from the other components of the wheat kernel and reducing it to a fine powder. Protein quantity and baking characteristics are important considerations in selecting wheat for bread flours. Canada Western Red Spring (CWRS) wheat is recognized as a premium wheat for bread production.

Wheat Intake

Incoming wheat is weighed, sampled and analyzed, passed through a preliminary cleaner and magnet, then stored according to class, grade and protein content.

Cleaning & Tempering

Cleaners remove weed seeds, dirt and other extraneous material through machines which separate by size (separator), specific gravity (destoner) and shape (disc separator). Frictional cleaning equipment scours the surface of the kernel, removing surface contamination and the outermost layers of the bran. During tempering, water is added to toughen the outer bran coats for easier separation from the endosperm and to mellow the endosperm for grinding.

The Milling Process

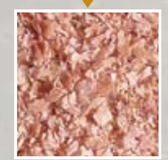
Milling is essentially a process of grinding and separating. Grinding is done on break rolls, sizing rolls and reduction rolls to reduce the endosperm into flour. Separation of the different sized flour particles is done using machines called sifters and purifiers.

Flours

Different flour separations may be combined to produce many different types of flour, including household flour, bakers' flour and noodle flour. Flour can be produced either by blending wheats at the milling stage, or by milling wheats separately and blending the resulting flours to meet customer specifications.

Flour Treatment

In some mills, flour is bleached immediately after it is milled. Flour may also be enriched to put back vitamins and minerals removed in the refining process. The flour is now ready to be packaged and sent to the bakery, store or warehouse.



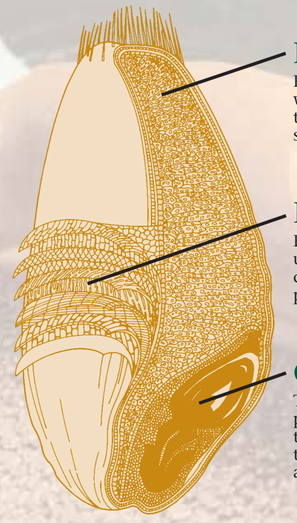
By-products

Most of the endosperm is recovered as flour. Germ, bran and unrecoverable endosperm are sold as by-products, usually for animal feed.

Wheat Kernel Cross-section

The kernel of wheat is a storehouse of nutrients that requires careful processing to separate it into its component parts.

Wheat Kernel



Endosperm

Flour is made from the endosperm which makes up about 83 per cent of the wheat kernel and is composed of starch and protein.

Bran

Bran is removed from the kernel and used in animal and poultry feed or combined with the endosperm to produce whole wheat flour.

Germ

The germ or embryo is the sprouting portion of the seed. It is separated from the endosperm and sold as a nutritional component for human and animal use.

Milling and baking photographs courtesy of the Canadian International Grains Institute; the Grain Research Laboratory, Canadian Grain Commission; Multi-Marques Inc.; Dover Flour Mills; Tony Nardella; and CWB collection. Diagram of wheat kernel courtesy of the Grain Research Laboratory, Canadian Grain Commission.

BREAD BAKING

Wheat flour is unique among cereal flours. When mixed with water, the protein in flour forms gluten, creating an elastic dough capable of holding gas. Properly mixed, gluten produces desired loaf volume and crumb structure in baked bread.

Methods & Ingredients

A good quality, consistent flour is key to the quality of the finished product. While bread is made by many different baking processes, the common objective is to develop the gluten. All methods are a combination of five basic processing steps:

1. Mixing

Flour, water, yeast and other ingredients are mixed to form a dough. Mixing develops the gluten in the flour for optimum gas retention at later stages of proofing and baking. Mixing incorporates air into the dough. In some processes, additives included at the mixing stage reduce or eliminate fermentation time.

2. Fermentation

Yeast organisms feed on sugars and produce carbon dioxide which expands the volume of dough. As fermentation proceeds, the gluten is conditioned and mellowed and becomes elastic.

3. Make-up

Dividing is the process that separates the bulk dough into pieces of the correct weight. Rounding removes the stickiness and restores a smooth surface to the dough pieces. The dough is allowed to rest after rounding in a process called intermediate proofing, which makes it easier to machine. The dough is sheeted into a flat piece, moulded into the desired shape and transferred for final proofing.

4. Final Proof

Generally, the dough is placed in a fermentation cabinet under constant temperature and humidity. Under these conditions gluten regains its elasticity. As fermentation continues, the dough increases in volume.

5. Baking

Baking transforms dough into bread. In the oven, the dough expands, takes on a stable shape, develops the desired flavor, and forms a crust. After baking, the bread is cooled and may be sliced and/or packaged.

FOUR BASIC BREAD TYPES

PAN BREADS

Pan breads usually require medium protein levels since the pan supports the loaf size and structure. They are typically produced in highly mechanized operations and are consumed in most markets around the world.

HEARTH BREADS

Hearth breads can be small rolls or large loaves and usually need medium to high protein flour to provide the necessary volume. They are consumed in markets around the world.

FLAT BREADS

Flat breads are common in the Middle East and Indian subcontinent. They are usually made from wheat with lower levels of gluten strength.

STEAMED BREADS

Steamed breads are a major baked product in China and other Asian countries. The flour needs to be highly refined to provide the desirable bright, white color.

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From Durum to Pasta

MILLING

There are fundamental differences between milling common wheat and durum wheat. While common wheat is milled to produce flour, the objective of milling durum wheat is to produce semolina and minimize the production of durum flour. Semolina is the coarse, granular particles of endosperm used for pasta processing.

Durum Wheat

Canada is a supplier of high quality amber durum wheat. Canada Western Amber Durum (CWAD) produces a high yield of semolina, with excellent pasta properties.

Wheat Intake

Incoming wheat is weighed, sampled and analyzed, passed through a preliminary cleaner and magnet, then stored according to grade.

Cleaning

Meticulous cleaning is required for durum wheat. Cleaners remove weed seeds, dirt and other extraneous material through machines which separate by size (separator), specific gravity (destoner and gravity table), and shape (indented cylinder). Frictional cleaning equipment (scourers) scours the surface of the kernel, removing the outermost layers of the bran.

Tempering

During tempering, water is added to toughen the outer bran coats for easier separation from the endosperm. Tempering also mellows the endosperm for grinding. Traditionally, durum wheat is tempered for a relatively short time. However, new technology in pasta manufacturing now enables finer semolina to be used, allowing for longer tempering periods.

The Milling Process

Milling is essentially a process of grinding and separating. Grinding is done on break rolls, sizing rolls and reduction rolls. Separation is done using machines called sifters and purifiers.

A durum mill has an extended break system in which grinding is relatively gradual. The endosperm is released in coarse granular form rather than as flour. The grading, purifying and sizing systems are more extensive in a durum mill, but the reduction system is very small compared to that of a flour mill.

Semolina

Semolina, the main product of durum milling, is coarser than the flour produced in common wheat milling. Desirable characteristics for semolina include good color, minimum dark or bran specks and uniform granulation.

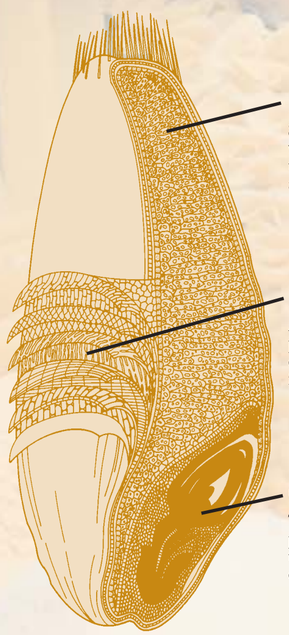
Small amounts of fine semolina and flour are produced. These are often combined with semolina to produce blended material which can be used for a wide range of long and short pasta goods.

Amber Durum Kernel Cross-section

The kernel of durum wheat is a storehouse of nutrients that requires careful processing to separate them into their component parts.

Amber durum wheat is different from most common wheats. Its kernels are larger and longer and the endosperm is especially hard and yellow in color.

Amber Durum Wheat Kernel



Endosperm

Semolina is made from the endosperm which makes up about 83 per cent of the wheat kernel and is composed of starch and protein.

Bran

Although bran and wheat germ are by-products of the milling process, both contain valuable nutrients. Bran is used in animal and poultry feed.

Germ

The germ or embryo is the sprouting portion of the seed. It is separated from the endosperm and sold as a nutritional component for human and animal use.

Pasta processing photographs courtesy of the Canadian International Grains Institute; the Grain Research Laboratory, Canadian Grain Commission; Borden Foods Canada; and Tony Nardella. Diagram of amber durum wheat kernel courtesy of the Grain Research Laboratory, Canadian Grain Commission.

PASTA MAKING

A quality pasta product begins with high quality raw material. Durum wheat is ideally suited for pasta because of its unique color, flavor and cooking qualities. Durum is also used to produce couscous and durum hearth breads.

Mixing

Semolina is mixed with water to form a lumpy dough. The dough is not fully developed until it passes from the mixing chamber into the extruder.

Extrusion

Dough is forced through various shaped dies, under very high pressures, to produce a wide range of different shapes of pasta products. The extrusion chamber is designed to draw off heat generated by the pressure and friction created during the extrusion process.

To prevent the pasta from sticking together in the drying process, long pasta is subject to a blast of air immediately after extrusion. Short pasta is transferred to a shaking pre-dryer to ensure it is separated.

Drying

Drying is a crucial part of the process for production of high quality pasta products. Humidity, air flow and temperature are carefully controlled as the pasta passes through several dryers. Modern high temperature drying systems improve pasta color and cooking quality. In the final stage of drying, cooling chambers return the dried pasta to normal atmosphere conditions. In general, the product is dried to a moisture level of about 12 per cent. The total drying time can take from six to 24 hours depending on the drying technology used.

Packaging

Following drying, the pasta is cooled, stored, cut and then packaged.

There are two main types of pasta – dry and fresh. Most durum semolina is used for the production of dry pasta.

DRY PASTA

Long Products

The highest quality durum semolina is needed for long pasta products. It must be free from specks and exhibit a bright yellow color. Long products, such as spaghetti, are consumed in markets worldwide.

Short Products

Short pasta products tend to be easier to make and do not need a lengthy drying time. They can be made from pure semolina or a granular blend of durum semolina and flour. Short products, such as macaroni, are consumed in markets worldwide.

FRESH PASTA

Fresh pasta has become more popular in recent years. Unlike dry pasta, which is extruded, fresh pasta is most often processed by sheeting and cutting, similar to the process used for noodles. Drying is not necessary. The addition of eggs in fresh pasta shortens its shelf life. Refrigeration is required due to its high moisture content. Consumption of this product is more prevalent in developed countries.

COUSCOUS

Couscous is prepared from steamed durum semolina and is usually served with spices, vegetables and meat. A staple in most parts of North Africa, couscous requires a high quality durum semolina.

Bread in a Bag & Butter in a Jar

This activity works best when students work in small groups or with a partner. If you are making bread as a microorganism experiment, vary the yeast, sugar, salt, or water temperature for interesting results.

BREAD IN A BAG

MATERIALS

- 4 cups (960 mL) flour
- 1 pkg. or 2 1/4 teaspoons (10.25 mL) yeast.
- Warm water
- 2 tablespoons (30 mL) sugar
- 2 teaspoons (10 mL) salt
- 1 tablespoon (15 mL) vegetable oil
- 1 Gallon (3.79L) heavyduty Ziploc bag

METHOD

Step 1

In a large one gallon (3.79L) Heavy Duty Ziploc bag, combine 1/2 cup (120 mL) all-purpose flour, yeast, 1/2 cup (120 mL) warm water, and sugar.

Step 2

Close the bag and knead it with your fingers until the ingredients are completely blended. Leave the bag closed, with contents in the corner and let dough rest 10 minutes (this is a good time to make butter.)

Step 3

Add 2 cups (480 mL) of flour, 3/4 cup (180 mL) warm water, oil, and salt. Mix well.

Step 4

Add enough all-purpose flour to make a stiff dough, about 1 or 1-1/2 cups. Close the bag and knead it (you may need to remove some air in the bag). Add more flour until dough no longer sticks to the bag. Let the dough rest for 5 minutes.

Open the bag and allow the dough to fall out onto clean or gloved (food handler's gloves) hands. Spray the hands or gloves with oil so there will be no sticking. Form the dough into a loaf, place in a loaf pan or onto a cafeteria cookie sheet. Cover with a damp tea towel or plastic wrap.

Remember the dough will grow 1-1/2 times larger, so leave space between loaves if baking on a cookie sheet. Allow it to rise 30 to 45 minutes. Bake 30-35 minutes in a 350°F (180°C) oven. Delicious!

BUTTER IN A JAR

MATERIALS

- Heavy whipping cream
- Jar with lid (plastic or glass)

  OR
- 2 oz. (60mL) plastic cups with lids. small plastic 2 oz. (60mL) cups with lids available from restaurant supply stores or your cafeteria.

METHOD

Step 1

Pour heavy whipping cream into a jar. Fill the container 2/3 full.

Step 2

Make sure the lid is secure.

Step 3

Shake briskly. The more cream in a container, the longer it will take. Cream in 2 oz. (60mL) containers should take 5-10 minutes.

Step 4

After butter is separated, you can add a small amount of salt.

For an experiment, try salting before shaking.

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