FSI FOOD SAFETY INVESTIGATION

Lesson 1.3

The Good Samaritans

Estimated time: One 50 min period

Instructional overview

Lesson 1.3 will show students the importance of beneficial microorganisms in food production and increase awareness of how important some microorganisms are in our daily lives. Making root beer requires beneficial microorganisms and is just one example of how microorganisms are both directly and indirectly involved in the production of many of the foods we eat and enjoy.

Instructional objective

1. Identify uses of bacteria, yeasts, and molds in the food industry.
2. Examine recipe ingredients and identify those where beneficial microorganisms are involved in production.
3. Follow a recipe to make root beer.

Assessment

Students will complete Investigation Activity 1.3. They will be informally assessed on group participation and their ability to complete the lesson activity within one class period. Students will complete the Investigation Activity handout to score at least 70% on the Grading Rubric.

Relevant learning standards - NSES-C, NSES-F, NSES-G, NHES-1

Equipment, supplies, and materials

1. PowerPoint Presentation - PPT 1.3.
2. Case Notes 1.3 – one per student or use ppt template.
3. Investigation Activity 1.3 Root beer – one per student or use ppt template.

*Note: it takes six days before the root beer can be consumed. Two liters of root beer requires:

- 7 cups of distilled or purified water.
- 1½ cups of white sugar
- ¼ teaspoon of active dry yeast
- 1 teaspoon of root beer extract
- One 2 liter plastic bottle
- Glass bowl for microwave use or a non-aluminum pan for use on a stove
- Funnel
- Measuring cup or ladle
- Refrigerator
- Plastic cups

References and background information

1. Food Science and Safety: G. Seperich.
2. Food Science and You: K. Mehas and S. Rodgers.
3. http://www.root-beer.org/index.php
4. GAPsNET www.gaps.cornell.edu

Interest approach

Based on the biological suspect profiles created previously, a number of suspects have been called in to question. Over the next few lessons, the innocent Good Samaritans will be separated from the Usual Suspects.

Classroom procedures

Teaching procedures	Content
Context with prior knowledge.	Let's review what we learned about suspect profiling. Why do investigators create suspect profiles? • Provide general descriptions • Narrow down an investigation • Refine suspect list Which five types of microorganisms did we create profiles for? • Bacteria • Viruses • Parasites • Yeasts • Molds Are all of these microorganisms harmful? NO. Recall from our first investigation that not all microorganisms are harmful. In fact, we need and depend on microorganisms for survival and food production.
State expectations for today's lesson.	At the end of today's lesson you will be able to: 1. Identify uses of bacteria, yeasts, and molds in the food industry. 2. Examine recipe ingredients and identify those where beneficial microorganisms are involved in the production. 3. Follow recipe to make root beer.

Hand out Case Notes 1.3 or show the ppt template to help students organize their notes. Have students record the definition of beneficial microorganisms in their Case Notes 1.3. The glossary in Appendix C contains all definitions presented in the Unit.	Today's investigation will help you eliminate the Good Samaritans from our suspect list. Good Samaritans are beneficial microorganisms associated with food production, and they do not cause foodborne illness. **Beneficial microorganisms** are helpful bacteria and fungi that are either added to or naturally occur in foods. These microorganisms are used to create unique flavors and textures in food.
Lead discussion on the use of beneficial microorganisms in the food industry.	Food scientists are constantly finding new and better ways to modify raw agricultural foods into products that will meet consumer's needs. As microorganisms grow and metabolize they release by-products. These by-products play an important role in preserving food and changing the texture and flavor of the food in which they are growing. The following list represents foods where beneficial microorganisms have modified one food to create another with interesting and different flavors. **From** — **To** Cucumbers — Pickles Cabbage — Sauerkraut Milk — Yogurt, cultured buttermilk, cheese Meats — Summer sausage, pepperoni • **Bacteria:** the most important bacteria used in food production are the Lactobacilliaceae family that have the ability to produce lactic acid from carbohydrates. For example, these bacteria convert fluid milk into yogurt. • **Yeasts:** the most beneficial yeasts in terms of food production are from the genus *Saccharomyces*. Yeasts play an important role in food microbiology as they produce desirable chemical reactions that result in the leavening of bread and the production of alcohol.

	• **Molds:** the genus *Penicillium* is important because it is involved in ripening and flavoring of a variety of cheeses. These are just a few examples of the many ways that food scientists use beneficial microorganisms to produce unique food products.
Ask students to form their Investigative Teams. Give students one minute to create a list of all the foods they know that depend on a beneficial microorganism to be produced. After one minute go around the room and have each group tell how many they have listed. Have a group read their list to the rest of the class. Write each food on the board. Then ask the other groups to share any other examples they may have.	Common examples students may come up with: • Yogurt • Bread • Cheese; Blue, Swiss, etc… • Wine • Beer
Take out a yogurt container and have a student read off the ingredients. Lead discussion about how we know beneficial microorganisms are used to make yogurt.	Yogurt is usually one of the first examples people think of when they think about beneficial microorganisms in food. • How do we know there are beneficial microorganisms inside? • Are they listed in the ingredients? • What does "Live Active Cultures" mean on the packaging?
Take out a bottle of soda containing citric acid. Have a student read off the ingredients.	Do you think beneficial microorganisms are needed to make this bottle of soda? • Why or why not? Does anything in that list sound like a beneficial microorganism? • Students will most likely respond "No". Beneficial microorganisms were absolutely involved in making this bottle of soda! Read the ingredients of the soda again – Where do you think citric acid comes from? • Students will most likely respond "Citrus fruit".

*An interesting fact about this same mold is that it is also one of the most common causes of fungal ear infections! http://www.innvista.com/HEALTH/MICROBES/bacteria/foodprod.htm http://www.eufic.org/web/article.asp?cust=1&lng=en&sid=4&did=13&artid=29	• Citric acid exists naturally in a variety of fruits and vegetables, but is mostly concentrated in citrus fruits like lemons and limes. Citric acid is a good preservative and is also used to add an acidic or sour taste to foods and soft drinks. When demand for citric acid began to go beyond what could be extracted from citrus fruits, the industry was forced to look for alternative sources. What they discovered was a type of mold that could produce huge quantities of citric acid when grown on sugar beet molasses. Today approximately 99% of world's citric acid is produced with the help of this mold.
Hand out Investigation Activity 1.3 or show the ppt template to help students organize their notes. See the Optional Activity, Making Frozen Yogurt, at the end of this lesson if another recipe is preferred. Group Investigative Teams together to create groups of 4-5.	Make sure to follow the recipe carefully. Have fun!
Context with future instruction.	The next step in narrowing our suspect list is to examine the method of operation or M.O. How do these microorganisms grow and reproduce? What are the conditions that favor their growth and reproduction?
Reflections for future use.	

The Good Samaritans

Case Notes 1.3

Name: _____ **Date:** _____

Beneficial Microorganisms: _____

_____

_____

_____

_____

_____

_____

The most common groups of microorganisms involved in food production are:

Type of microorganism	Example
1.	
2.	
3.	

List three common foods that would not be possible without beneficial microorganisms.

_____

_____

_____

What is the genus of the beneficial microorganism needed to produce root beer? _____

_____

_____

What type of microorganism is it? _____

_____

_____

The Good Samaritans

Investigation Activity 1.3

Root beer, ready to drink after six days

*Recipe makes 2 liters

- 7 cups of distilled or purified water
- 1½ cups of white sugar
- ¼ teaspoon of active dry yeast
- **Note:** Champagne yeast can be used and decreases the strong odor given off when opening a bottle using bread yeast.
- 1 teaspoon of root beer concentrate

Mixing

Measure the water into a glass bowl and heat it in a microwave on the high setting for three minutes. You can also heat the water in a non-aluminum pan on a stove burner until the water is lukewarm. Do not overheat it, though, or you will deactivate the yeast. Add the sugar, dry yeast, and root beer concentrate to the water and stir slowly until the sugar and yeast dissolve.

Bottling

Set a small plastic funnel into the mouth of a 2 liter plastic bottle. Use a small cup or ladle to pour the soda mixture through the funnel. Fill the bottle, leaving 2-3 inches of air space at the top. Remove the funnel and screw on the bottle cap tightly. (If air leaks out, the root beer will not carbonate properly).

Adding the fizz

Lay the filled bottle on its side in a warm place and leave undisturbed for four days. During this time the root beer will carbonate – the sugar and the yeast react to form tiny carbon dioxide bubbles that give soda its fizz. On the fifth day, put the root beer in the refrigerator to chill. It will be ready to drink the following day.

**This is from an old recipe, citation unavailable.*

This assignment will be graded using the following Grading Rubric:

Assessment Criteria	Maximum Points	Points Scored
The student completed their Case Notes.	**3**	
The student actively participated in the creation of root beer.	**1**	
The assignment was neat, organized, and handed in on time.	**1**	
TOTAL	**/5 =**	**%**

Optional Activity: Making Frozen Yogurt

Materials:

- 1 cup milk
- 1 cup plain yogurt
- ¼ cup sugar
- 1 envelope (1.3 oz) Whipped Topping Mix
- ½ teaspoon Pure Vanilla Extract
- Crushed ice
- 1 cup of rock salt or table salt
- 1 quart-sized freezer bag
- 1 gallon-sized wide mouth jar with lid
- Duct tape
- Plastic spoons
- Plastic cups

Directions

1. Place the following ingredients in the 1-quart sized freezer bag:
   - 1 cup milk
   - 1 cup plain yogurt
   - ¼ cup sugar
   - 1 envelope (1.3 oz) Whipped Topping Mix
   - ½ teaspoon Pure Vanilla Extract
2. Press the bag's seam to seal. Fold a piece of duct tape lengthwise over the seal.
3. Place the bag with the ingredients inside the gallon-sized wide mouth jar.
4. Pack the container with crushed ice around the smaller bag. Pour 1 cup of salt evenly over the ice.
5. Seal the container.
6. Take turns VIGOROUSLY shaking the container for 10 minutes.
7. While you are busy shaking for 10 minutes, think about and discuss the following "Questions for thought" as a group. Record your answers on a separate piece of paper with all of your names on it to turn in.
   - What would happen if we used skim milk instead of 2 percent milk? Why?
   - What would happen if we used whole milk? Why?
   - What would happen if we used whole milk yogurt instead of low fat? Why?
   - What would happen if we used nonfat yogurt? Why?
   - *Bonus: Why do we add salt to the ice? Is it necessary?
8. After shaking for 10 minutes open the container and check the contents of the inner bag. The frozen yogurt should be soft-serve consistency. If it is still in a liquid state, return to the container and shake for another 2-5 minutes.

9. Once you have achieved the desired consistency, remove the inner bag with the ingredients from the outer bag/container.
10. Wipe off the bag to be sure salt water does not get into the frozen yogurt.
11. Cut off one corner of the bag and gently squeeze into the plastic cups.
12. Eat plain or add crushed candies and enjoy this microb-alicious treat!

The Microbiology of Frozen Yogurt

Review the food ingredients used in the Frozen Yogurt recipe. Circle the ones you believe microorganisms had a part in producing.

Sugar	**Vanilla Extract**	**Milk**
Yogurt	**Whipped Topping**	**Mix Candy Toppings**

As your teacher describes the different ingredients, use the area below to describe how the beneficial microorganisms are involved.

Ingredient	Describe how the Beneficial Microorganisms are Involved
Sugar	
Vanilla Extract	
Milk	
Yogurt	
Whipped Topping Mix	
Candy toppings	