



FOOD IRRADIATION...FRIEND OR FOE?

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Annotation:

In this presentation, students will learn about the application of nuclear radiation to food sterilization. Students will learn why food is irradiated, the types of food irradiated, the types of irradiation used, and the effects of irradiation on foods.

Primary Learning Outcomes:

Students will be able to define food irradiation and describe its use in the food industry.

Students will be able to identify and describe the radiation sources employed in food irradiation and compare these to the four types of nuclear radiation.

Students will be able to identify commonly irradiated foods and the purposes for which foods are irradiated.

Students will be able to describe the process by which irradiation sterilizes food.

Assessed GPS:

SCSh3. Students will identify and investigate problems scientifically.

- a. Suggest reasonable hypotheses for identified problems.

SCSh6. Students will communicate scientific investigations and information clearly.

- b. Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.
- c. Use data as evidence to support scientific arguments and claims in written or oral presentations.
- d. Participate in group discussions of scientific investigation and current scientific issues.

SPS3. Students will distinguish the characteristics and components of radioactivity.

- a. Differentiate between alpha and beta particles and gamma radiation.
- d. Describe nuclear energy, its practical application as an alternative energy source, and its potential problems.

Duration:

Preparation: 45 minutes

Introduction: 10 minutes

“Food Irradiation” PowerPoint Presentation: 20 minutes

Conclusion: 10 minutes

Total Class Time: 40 minutes

Technology Connection:

Requirements: “Food Irradiation” MS PowerPoint Presentation, PC compatible computer with speakers, MS PowerPoint, QuickTime Player, Real One Player, and LCD computer projector.



Web Links: Check out the following links for more information.

Title: CDC's FAQ about Food Irradiation

URL: <http://www.cdc.gov/ncidod/dbmd/diseaseinfo/foodirradiation.htm>

Title: FDA Food Irradiation Article

URL: <http://www.fda.gov/opacom/catalog/irradbro.html>

Title: International Atomic Energy Agency (IAEA) Facts about Food Irradiation

URL: <http://www.iaea.org/programmes/nafa/d5/public/foodirradiation.pdf>

Procedure:

Teacher Preparation:

Review presentation and websites to familiarize yourself with the topic.

Estimated Time:

45 minutes

Introduction:

Display the first slide of the PowerPoint presentation and have students write a one-minute paper answering the question: "Would you eat a pizza that had been exposed to nuclear radiation?"

Why or why not?" Students should briefly explain their answer based on their prior knowledge.

Briefly review papers with students.

Estimated Time:

10 minutes

"Food Irradiation" PowerPoint Presentation:

Slide show outline and teacher instructions:

- "Would you eat a pizza...?"
 - See introduction
- "Which foods are irradiated?"
 - Review list of foods and purposes for irradiation.
- "What is Food Irradiation"
 - Review the definition of food irradiation
- "How does irradiation work?"
 - Review irradiation process.
- "What are the sources of radiation"
 - Review radiation types.
 - Remind students that the four types of nuclear radiation as follows:
 - Gamma ray – emitted from radioactive nuclei; exhibit high energy, high penetration
 - Alpha Particle – 2 proton/2neutron (He) nuclei emitted from radioactive nuclei; high energy, low penetration

- Beta Particle – electrons emitted from radioactive nuclei; intermediate energy, intermediate penetration
 - Neutron – neutrons emitted from radioactive nuclei; non-ionizing; high penetration
 - Emphasize that X-rays are relatively high energy waves but of lower energy than gamma rays.
- “Cobalt-60 Gamma Irradiation Plant”
 - Click title hyperlink to play gamma irradiation plant video.
 - Note: This video was taken from an online news article posted on CNN.com. The article and video can be found at <http://www.cnn.com/HEALTH/9711/25/irradiation/>.
 - At end of video, press Alt-Tab to return to presentation.
 - Review features of gamma irradiation plant.
- “Electron Beam/X-Ray Irradiation Plant”
 - Click title hyperlink to play electron beam video.
 - At end of video, press Alt-Tab to return to presentation.
 - This video depicts the setup of an X-ray radiation treatment. X-rays are employed as a final sterilization for packaged food that is ready to be shipped. X-rays are able to penetrate thick foods and packaging. Electron beam, however, are only able to penetrate foods to a depth of 3 cm. Therefore, electron beam irradiation can only be used on unpackaged, thin foods. In both cases, the electron beam is produced electrically and can be switched on and off. There is no radioactive source involved.
- “How do radiation sources compare?”
 - Review comparison.
- “What changes occur in the quality of irradiated foods?”
 - Review changes. Note that “off-flavors” refers to the creation of undesirable flavor compounds through chemical reactions catalyzed by irradiation.
- “What are the benefits?”
 - Review benefits.
- “How do you know if your food has been irradiated?”
 - Review labeling.
- “Are irradiated foods safe?”
 - Review conclusion.
- “So, now would you eat an irradiated food product? Why or why not?”
 - See conclusion.

Estimated Time:

20 minutes

Conclusion:

Have students revise their one-minute papers, incorporating the information presented in the “Food Irradiation” PowerPoint presentation. Again, briefly review the student papers and collect for assessment.



Estimated Time:
10 minutes

Assessment:

Assessment should be based on completion and revision of the one-minute paper. Student reasoning should be based on sound scientific logic and revised papers should accurately incorporate the material presented in the presentation. Additional assessment may be performed using the quiz provided.



Name:

Date:

Class Period:

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Quiz

1. Name two foods that are currently approved for irradiation by the FDA.
2. Name two purposes for which foods are irradiated.
3. Briefly explain how irradiation sterilizes food.
4. Name the three types of radiation used to irradiate foods.
5. Match the definitions on the left with the terms on the right.

_____ Very high energy
electromagnetic rays emitted from
radioactive nuclei.

a. Alpha Particle

_____ Similar to the electron beam,
this radioactive particle consists of
one electron.

b. Beta Particle

_____ Not used in food irradiation,
this radioactive particle consists of a
helium nucleus, two protons and two
neutrons.

c. Gamma Ray

_____ Produced indirectly by electron
beams colliding with gold sheets,
these high energy rays have
frequencies just below gamma rays.

d. X-Ray

