FOOD SCIENCE

Environmental monitoring for food safety

Focus questions	How might we test the food production environment for potential contamination? What are the best cleaners to use for food safety in our lab?
Learning target	Students will demonstrate environmental monitoring for aerobic organisms.
Vocabulary	Petrifilm®, cleaning, sanitizing

HS LS2-7 Ecosystems: Interactions, Energy, and Dynamics

Performance expectation HS-LS2-7	**Classroom connection:** Students will test a lab surface before and after cleaning to determine if the surface is food safe.

Science and engineering practices

Constructing Explanations and Designing Solutions	**Classroom connection:** Students will determine the effectiveness of cleaning agents on a lab surface through research and evaluation of data gathered.

Disciplinary core ideas

ETS1.B: Developing Possible Solutions	**Classroom connection:** Various cleaning agents may be used to evaluate their effectiveness in making the lab surface food safe.

Cross-cutting concepts

Stability and Change	**Classroom connection:** Lab surfaces must be clean to be safe for food preparation.

Background

An Environmental Monitoring Program is a systematic way of testing the food production environment, including all food contact surfaces, for potential contamination such as pathogens, to verify the effectiveness of your food safety programs. Environmental Monitoring Programs for food safety also facilitate compliance with regulatory requirements set by agencies like the FDA and USDA to help maintain product quality and brand reputation. The purpose of this lesson is to provide a standardized test to ensure the safety of lab stations in a food science facility.

Prior knowledge

Students should know how to follow standardized directions, operate a disposable or micropipette, and interpret the growth of a potential pathogen that appears on an agar plate.

Suggested timing

- 1 period to clean and collect samples
- 1 period to interpret results after 24–48 hours

Materials

- Distilled water
- Soy-based cleaners (i.e. Seventh Generation, BioKleen, Meyer)
- Whirl Pak® bags
- Graduated cylinder
- 2 Aerobic Count Petrifilm per lab group
- Film spreader
- Sterile swabs
- Micropipette (P-1000) and tips (or disposable pipettes)
- 10% bleach
- Incubator
- Sharpie markers®

Teacher preparation

1. Determine where students will collect samples. If planning to carry out any food preparation, all lab tables could be tested, cleaned and sanitized, then tested again.
2. Prepare lab stations with cleaners, Whirl Pak bags as needed, Petrifilms, film spreader, and Sharpies.

Procedure

1. Discuss the importance of food safety. Some sample questions include: Who is responsible for ensuring the safety of our food supply? Who is responsible for food safety at your home? What technologies help keep our food safe?
2. Have students follow the directions on the student document.

Differentiation

Other ways to connect with students with various needs:

- **Local community:** Students can use the monitoring protocol to test surfaces and cleaners in their own kitchens and share their results with parents.
- **Students with special needs (language/reading/auditory/visual):** Students with disabilities may be provided extra time to complete the collection of samples.
- **Extra support:** Students can watch this YouTube video on cleaning and sanitizing: **youtu.be/r0sWf0jf6T4**
- **Extensions:** Many other surfaces may be tested with different petrifilms to determine if there are potential contaminants in the environment. 3M makes yeast and mold count petrifilms and several that will test for *E. coli* and other pathogenic bacteria.

Student handout

Reflection

1. What is the total CFUs per area that you found?
   Reminder: *# of red/violet colonies on plate × volume of solution in Whirl Pak bag (10mL) = total CFUs per area sampled (5cm^2).*

Answers will vary depending on area sampled.

2. Was cleaning and sanitizing effective in reducing the number of colonies?

Yes. The 10% bleach solution should eliminate most bacteria from the surface left over after cleaning.

3. Was one cleaner better than another?

Answers will vary depending on which cleaner was used. It may be difficult to tell since all is sanitized after cleaning.

4. Might there have been a difference in the colony count if you would have swabbed after cleaning, but before sanitizing? Why?

Yes. The 10% bleach solution should eliminate most bacteria from the surface left over after cleaning.

Assessments

Rubric for assessment

Skill	Developing	Satisfactory	Exemplary
Determine the effectiveness of specific cleaning agents on a lab surface through research and evaluation of data gathered.	Student tested an area of the lab before cleaning, but ineffectively cleaned before testing again.	Student tested an area of the lab before cleaning, used a cleaner and compared the resulting bacterial growth, then designed a solution to cleaning lab surfaces.	Student tested an area of the lab before cleaning, used a cleaner and compared the resulting bacterial growth, designed a solution to cleaning lab surfaces, and is able to discuss the importance of cleaning and sanitizing.

Rubric for self-assessment

Skill	Yes	No	Unsure
I was able to properly clean a lab surface for food preparation.			
I determined which cleaner was most effective for providing a food-safe environment.			
I described a solution for preparing a surface for food preparation.			