Middle School Career Awareness Elective Course

Biotechnology 100

Solutionary Phase	Fundamentals
Lesson # and title	Lesson Five: Making Bioplastic #3
Duration	45 minutes

Lesson Overview

After making plant-based bioplastics, students make bioplastic from agar, which is made from red algae (protists), and glycerin (glycerol), which is made from plants. Making the bioplastic takes one lesson, but it takes several days to dry. Once dried, students will be able to manipulate the material to take the shape of a product, if they ultimately choose to use this product for their solution.

Learning Objectives

Create a bioplastic material using a combination of agar, glycerin, and water.

Content Standard(s)

NGSS
MS-PS1-3: Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

EP&Cs: Principles 1, 4, 5

College and Career Connection(s)

Industrial biotechnology, Biotechnology, Product Design, Product Development, Manufacturing, Biology, Genetic engineering, Artist

Equipment, Instructional Resources, and Materials

Agar (5 g) per group
Glycerin (5 ml) per group
Water (250ml) per group
Pots
Hot plates
Silicone mixing utensil
Silicone molds
Digital Scales
Plastic transfer pipettes
Food coloring (optional)

Suggested Student Grouping

Individual and Pairs

Vocabulary

Agar

The Lesson

Preparation

Collect all the materials and review the process. It is advised that teachers practice making these materials prior to class to be able to troubleshoot issues.

Lesson Procedure

Link to Lesson Slide Deck:
https://docs.google.com/presentation/d/1xSFCnSclHjCobrBiDhT8_wdE_qB1UY5UVa2z47Y4lpg/edit?usp=sharing

Activity/Task	Description	Time (min)
Why bioplastic?	Students learn that bioplastics can be produced and used during the manufacturing process to replace plastics in made goods, including household items.	5
Making bioplastic	Use this procedure to produce bioplastic: 1. Pre-measure 5g of agar 2. Prepare syringe of glycerin with 5 ml 3. Pour 250ml of water into pot and set on hot plate set to medium-high 4. As water begins to warm, *slowly* add agar while mixing to dissolve 5. Add 10 drops of glycerin to water while mixing 6. Raise temperature to high 7. When solution begins to boil, reduce temperature to low 8. Mix solution occasionally while simmering for 5 minutes 9. Pour solution into molds 10. Clean all tools and utensils Variations: 1. Have different student groups use differing amounts of glycerin (10 drops, 20 drops, 30 drops) 2. Add 2-3 drops of food coloring to the water to add color **Allow 3-5 days to dry. The product will harden and shrink over time.**	40

Assessment and Extension

Students have created the bioplastic solution, and it is set aside, undisturbed, so the bioplastic can develop.

Read this article on algae-based fabrics being produced for the fashion industry:
https://inhabitat.com/fabrics-from-natural-materials-studio-are-made-from-algae/