Middle School Career Awareness Elective Course

Biotechnology 100

Solutionary Phase	Fundamentals
Lesson # and title	Lesson Three: Making Bioleather
Duration	45 minutes

Lesson Overview

Students will make kombucha leather--their first biodegradable material. This material will take one lesson to produce, at least ten days to grow, and two 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 bioleather material using a combination of kombucha and green tea.

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, chemistry, manufacturing, fashion design

Equipment, Instructional Resources, and Materials

Kombucha starter tea (with SCOBY)
Electric kettle
Filtered water
Green tea bags
Gallon jar
Cheese Cloth
Drying rack
Butcher block moisturizer
Paper towels

Suggested Student Grouping

Individual and Pairs

Vocabulary

Fermentation
SCOBY (Symbiotic Culture of Bacteria and Yeast)

The Lesson

Preparation

1. Please watch this video that details the procedure of how to make kombucha leather: https://drive.google.com/file/d/1r0FKM8E4-Ly4S-ES4RAxddV1p73Boyet/view?usp=sharing
2. Make the green tea prior to class:
    a. Boil one gallon of water.
    b. Add two cups of sugar to dissolve.
    c. Add eight green tea bags.
    d. Allow to steep for 20-30 minutes.
    e. Allow to cool to room temperature.

Lesson Procedure		
Link to Lesson Slide Deck: https://docs.google.com/presentation/d/1opACzZUnl4zsoN2kuw4Y5TjT6ew5FS-E9yqdD1inPEM/edit?usp=sharing		
Activity/Task	**Description**	**Time (min)**
SCOBY and Kombucha	● Students learn about how kombucha is made. ● Students learn about the process of fermentation. ● Students learn what a SCOBY is, and how it is used to make kombucha.	15
Making Kombucha Leather	● Students should work in pairs. <u>Growing kombucha leather:</u> 1. Prepare green tea and sugar solution, and allow it to cool prior to the start of class. (see preparation above) 2. Distribute three petri dishes per student group. 3. Students use isopropyl alcohol spray to disinfect petri dishes. Allow for alcohol to evaporate prior to use. 4. Students use sharpie to write their names on the bottom of the petri dishes. 5. Students combine three tablespoons of the green tea solution and three tablespoons of kombucha starter tea solution into each petri dish. 6. OPTIONAL: Students select from various food coloring. Add two drops of food coloring to each petri dish and mix. 7. Students add a small piece of SCOBY - about the size of a fingernail - to each petri dish. 8. Students cover petri dishes with lids. 9. Place petri dishes in an undisturbed location that, ideally, is warm (75 degrees). 10. Allow kombucha leather to grow for 10-12 days. <u>Removal, drying, and moisturizing:</u> 11. Carefully, remove the upper layer of kombucha leather from the petri dish, making sure the SCOBY piece has become disconnected. a. Leaving the SCOBY in the solution will allow another layer of kombucha	30

	leather to form over the next couple of weeks. 12. Carefully, place kombucha leather on a drying rack. 13. Allow to dry for 3 days. 14. Once the kombucha leather is dry, apply a small amount of butcher block moisturizer to the leather and work in using paper towels. This will make the leather more pliable and easier to manipulate.	

Assessment

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

HOMEWORK

In preparation for lesson four, have students read this article and answer these questions:

Students read "More than ever, our clothes are made of plastic. Just washing them can pollute the oceans".
Suggested questions based on article:

1. What percentage of clothing materials are made from plastics?
2. What is the problem with putting clothing made from plastics in the washing machine?
3. What is *microplastic*?
4. Where could microplastics end up once they are in the oceans?
5. What could we do to prevent microplastics from entering our environments?

Additional Resource: https://newatlas.com/materials/sheets-mushroom-leather-greener-clothes-shoes/