Teacher's Preparatory Guide

This activity provides an alternative to the guided inquiry student version to allow independent investigation.

Name:_____Date:_____Class:_____

Student Worksheet
(with answers)

Catalytic Conversions: Independent Inquiry

Avoid splashing hydrogen peroxide into the eyes or onto other areas of the body. Any spills of calcium chloride on the skin should be immediately flushed with water

Materials

- 10 ml of alginate-glass MnO_2 mixture
- 30 ml 5% $CaCl_2$ solution
- 3% H_2O_2 solution
- stirring rod
- plastic syringe or pipette
- petri dish
- Vernier caliper
- hand lens or stereomicroscope
- plastic screen or cheesecloth
- tap water
- paper towel
- blank data table (sphere)
- blank data table (cylinder)

Procedure

Drop the alginate mixture into 30 ml 5% $CaCl_2$ solution.

Challenge #1

Make 2 spheres & 2 cylinders.

The dark alginate mixture clumps in spheres if dropped from above the cup. If the alginate mixture is released from the dropper under the surface, long dark tubes form.

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Challenge #2

Make 10 spheres and 10 cylinders and measure them with calipers to check for size and uniformity.

Students use calipers to measure the diameters and record them in data tables (see page 2 of this student worksheet).

Challenge #3

Sort the alginate structures into groups of similar size and shape. Place them into a petri dish half filled with 3% hydrogen peroxide. Then look at the structures in the dish under greater magnification. Describe what you now see and identify questions to ask.

Students must record in a table (page 2) their observations about the size and shape of the structures removed from $CaCl_2$, the structures in H_2O_2, and the structures under magnification.

SAVE the structures you made today because we will use them in the next lab!

Students may use the tables below during their investigation. Simply print and cut into strips.

Challenge # 2 **Name**_____

Sphere	1	2	3	4	5	6	7	8	9	10
Diameter (mm)										

Cylinder	1	2	3	4	5	6	7	8	9	10
Diameter (mm)										
Length (mm)										

Challenge # 3 **Name**_____

Alginate structures in H_2O_2	Observations under magnification: What else do you observe? Sketch and describe.
Bubbles appear on surface of structures.	*Gas bubbles are seen forming and leaving the surface of the structures, small bubbles fuse into larger ones before they escape. There are more bubbles on the cylinders than on the spheres.*

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Analyze the Results

1. Show how you calculated the percentage of alginate structures that were the same size. Show all of your work on a separate page.
2. What factors were controlled in this reaction? *temperature, volume of peroxide, volume of reaction container, mass of alginate structures*

Draw Conclusions

1. How successful was your group in making alginate structures that are the same size? Justify your success through the percentage of structures that were the same size and shape.
   Example answer: We were able to get 85% of spheres the same size and 68 % of the cylinders the same size.
2. What factors affected your ability to be consistent?
   Example answer: whether I squeezed the pipette above or below the water, how quickly I squeezed, how long I squeezed the pipette, how much alginate was in the pipette
3. Nanoparticles are structures that cannot be seen without a powerful microscope. They are much, much smaller than the structures you made today. What problems may researchers run into when trying to create a batch of nanoparticles that are all the same size and shape?
   Example answer: The chemical and physical methods of creating the nanoparticles might result in variations in size and shape. An electron microscope is needed to see and measure the particles.

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