

Dissecting a Diaper to Investigate Polymers

Part A: EXPLORE: What is a Polymer?

Here is what you need to share:

Mystery Polymer A
 Mystery Polymer B
 Mystery Polymer C
 Four medicine cups (or other small, clear cup)
 Water

What is a polymer?

What are hydrogel polymers like? Let's explore!
 You have three hydrogel polymers to investigate.
 Follow the directions to do controlled observations
 of each of the three polymers.

Procedure:

1. Separate three medicine cups. Pour mystery polymer A into the first medicine cup. Pour mystery polymer B into the second medicine cup. Put the mystery polymer C into the third. Each of these is a type of hydrogel polymer.
2. Make your observations about each of the powders in your data chart. You should record what you SEE, what you SMELL, what you FEEL, what it SOUNDS like when you touch it and move it around.
3. Use the fourth medicine cup to add water to each of the cups. What are your observations as you add the water? Add more water. What happens? Allow the polymer to sit in the water for 5 minutes. Make your observations again. Has anything changed?
4. The powders have properties that make them useful for different things. One of the polymers is Instant Snow. One of the polymers is used by florists because it releases water slowly to provide water to flowers. One of the polymers is used in diapers. Which powder is which?

If you are making your own data chart, you can use the suggested design to help you.

If you want to learn more about polymers, try this!

<https://www.pslc.ws/macrog/kidsmac/basics.htm>

OBSERVATIONS	Mystery Polymer A	Mystery Polymer B	Mystery Polymer C
What do you SEE			
What do you SMELL			
What do you FEEL			
What do you HEAR			
What happens after I add water?			
What do you SEE			
What do you SMELL			
What do you FEEL			
What do you HEAR			
Which type of powder do you think it is?			

Part B: DISSECT: What is the Anatomy of a Diaper?

Here's what each camper will need:

1. One gallon sized baggie
2. One medicine cup
3. A different brand diaper (if there is only one camper-there will be two diapers so that a comparison can be made)

To share:

4. Newspaper, large plastic garbage bag or another material to cover your workspace and make cleaning up easier

To **dissect** means to separate something into pieces in order to study its internal parts.

A diaper has been designed to keep a baby dry by keeping moisture away from a baby's skin. The hydrogel most commonly used in diapers is sodium polyacrylate. It's added to the core of disposable diapers to soak up urine. This helps to prevent diaper rash. The diaper is also designed to prevent urine from leaking out of the diaper to keep the baby's clothing dry. The anatomy of the diaper is a good example of chemistry and engineering working together to solve a problem.

Let's dissect the diaper and analyze the design!

Procedure:

1. Cover your workspace with newspaper or by a large, plastic garbage bag. This will make cleaning up easier later.
2. Place a new diaper on the newly covered surface.
3. Make a drawing of the diaper design. Why was it designed this way? Label your observations about the construction.
4. Look carefully at the lining. Make some observations about the material used to make the diaper. What does it look like? How does it feel?
5. Carefully cut through the diaper lining and remove all of the stuffing material.
6. Put all of the stuffing material into your gallon sized plastic bag. Scoop up any material that may have fallen onto your work surface and put it into the plastic bag.
7. Seal the bag. Open a small area and blow some air into the bag so that the bag puffs up a little bit.
8. Shake the bag for a few minutes. You will begin to see that a powder begins to gather in the bottom of the bag. This is the super absorbent polymer powder.
9. Open the bag and while the diaper is still inside the bag, begin to pull apart the cotton. This will help to release any other polymer that is trapped in the cotton.
10. Continue to pull at the cotton until you are certain that the majority of the polymer has been released and is now at the bottom of the plastic bag.
11. Remove the cotton from the bag. Use the medicine cup to measure the amount of polymer removed from the diaper. Record this amount in your data chart.
12. If you have a second diaper, you will need to repeat this procedure again to collect the polymer. Record this amount in your data chart.

INTERESTED IN LEARNING MORE? <https://www.youtube.com/watch?v=s6GBfrJd2hs>

Part C: INVESTIGATE: How much water can different sized diapers hold?

Here's what each camper will need:

1. The polymer that has been removed from the diaper.
2. Gallon sized plastic bag

To share:

3. Measuring cups from your kitchen (optional)
4. Salt

There are many brands of diapers. When we dissected your diaper, you removed the sodium polyacrylate from each of the different brand's diapers. Does one brand work better than another? You can test this out!

We want to test our question in a scientific way. This means that we need to do **EXACTLY THE SAME THING** to the polymer from each diaper.

Procedure:

We want to know how much water is absorbed by each brand of diaper. You will be deciding on your own method for testing the different diaper brands. How can we test the polymers in a scientific way?

1. Put your polymer into its gallon bag. Make sure that you label your bag, so that you remember which diaper you are testing.
2. You will be pouring water into the gallon bag a little bit at a time and mix. Decide on how much water you will add each time. We suggest you add 30ml at a time. You can measure this easily with your medicine cup. If you have measuring cups in your kitchen that you can use, you can measure a different amount each time. But **REMEMBER**: You will need to add water **EXACTLY THE SAME WAY WITH EACH DIAPER**. Keep track of how much water you add to the bag by recording it in your data chart.
3. Each time you add water, you will need to mix it with the powder. You will need to do this **EXACTLY THE SAME WAY WITH EACH DIAPER**.
4. Continue to add water to the powder in the bag until the powder can no longer hold any more water. If you see liquid water in the bag after mixing it with the powder, that will tell you when to stop. However, you will need to check with one another until you agree that you are done. You will need to see **EXACTLY THE SAME WAY WITH EACH DIAPER**.
5. When you are done, add up the total amount of water added. Which diaper brand absorbed the most? Rank the diapers. (1-BEST, 2, 3-WORST)

To safely clean up the polymer:

Add a few teaspoons of salt, stir it with a spoon, and watch what happens. Salt messes up the gel's water-holding abilities. When you're finished, you can pour the saltwater goo safely down the drain.