

Lab 2: How Do Diapers Work?

Goal:

In this lab you will compare a generic disposable diaper with a name brand disposable diaper. You will experiment with the chemical responsible for absorbing the water (sodium polyacrylate) and you will decide which type of diaper is the better deal.

Report:

You have been hired as a free-lance author to write an article for *Parent's* magazine. Write an article comparing the generic diaper with the name brand diaper. Discuss the tests you ran, what you found out, and give your opinion on the better of the two diapers (and how you arrive at this conclusion).

Also include a discussion of sodium polyacrylate and how it works. Explain how salt affects the performance of sodium polyacrylate and how this relates to urine. Think about and describe at least two other uses for sodium polyacrylate besides its use in disposable diapers.

The article should be informative, written for the layperson, *scientifically accurate*, and incorporate **all** of your observations, data, and calculations in an organized manner.

Procedure:

Part One: Making the Synthetic Urine

1. Place 1000 mL (1 L) of deionized water in a large flask.
2. Add 24.3 g of urea to the water and stir until dissolved.
3. Add 10.0 g sodium chloride (NaCl), 6.0 g potassium chloride (KCl), and 6.3 g sodium dihydrogen phosphate (NaH_2PO_4) to this solution and stir until dissolved.
4. Add a few drops of yellow food coloring to the solution (for affect).

Part Two: Comparing the Engineering of the Diapers

1. Make observations about both types of diapers. Compare their size, mass, how they are put together, etc.
2. Tear apart each diaper and compare how the diapers are made. Be careful at this point to not lose any of the absorbent powder in the diapers.

Part Three: Testing the Absorbent Powder and Sodium Polyacrylate with Pure Water

1. Isolate as much absorbent powder from each type of diaper (generic and name brand) as you can. Do this by tearing apart the diaper, removing the stuffing, and shaking it in a Ziploc baggie.
2. Measure 0.10 g of absorbent powder from each type of diaper and place each sample in a separate 250 mL beaker. Measure 0.10 g of sodium polyacrylate and place it in a 250 mL beaker.
3. Take the mass of each of the beakers with the samples.
4. Use a squirt bottle filled with deionized water to slowly add small amounts of water to each sample. Gently mix each sample (by mixing with a spatula or stirring rod) and wait a sufficient amount of time before adding additional water. It's best to do this test with all three beakers at the same time (to make more of a direct comparison between them).
5. Once you are convinced that as much water as possible has been absorbed, take the mass of the beakers with the gel in it. Determine the mass of water absorbed for each.

6. Add a spatula-tip filled amount of table salt (sodium chloride, NaCl) to each sample, stir, and make observations.

Part Four: Testing the Sodium Polyacrylate with Synthetic Urine

Repeat the procedure from Part Three with only the pure sodium polyacrylate (0.10 g) and using synthetic urine instead of deionized water.

Part Five: Testing the Total Absorbency of the Diapers

1. Obtain two new diapers (one name-brand diaper and one generic diaper).
2. Add 90.0 mL of synthetic urine to each of the diapers and record all observations. Pay attention to the time for absorption. The average bladder size of a one-year old child is 90 mL. Are both diapers able to adequately absorb this?
3. Add synthetic urine to each of the diapers until the diaper cannot hold any more. The diaper cannot hold anymore when you lay the diaper flat (so it forms a bowl-like shape) and the urine either drips out of the diaper or a pool of urine forms in the diaper. Record how much urine (in mL) each can hold.

Part Six: Gathering General Information about the Diapers

1. Determine how much each package of diapers cost and the quantity per package.
2. Calculate the cost per diaper for the generic and name brand type.

Data and Calculations:

1. Include data and calculations for mass water absorbed per gram of sodium polyacrylate and mass "urine" absorbed per gram of sodium polyacrylate. Compare these ratios.
2. Include data and calculations for mass water absorbed per gram of absorbent powder from the generic diaper.
3. Include data and calculations for mass water absorbed per gram of absorbent powder from the name brand diaper.
4. Include data for the total mass "urine" absorbed by the generic diaper. The density of urine is 1.014 g/mL. Use this density to assist you in converting from volume to mass.
5. Include data for the total mass "urine" absorbed by the name brand diaper.