

## Detergent versus Soap



### Intro

Have you ever wondered why we wash our clothes in detergent but wash our hands in soap? What's the difference? Soap has molecules that surround the dirt and oil on your hands and then they get washed away with water. Detergent is soap plus things called **builders** that reduce the hardness of the water. **Hard water** is a problem because of calcium and magnesium ions in it. These ions bond with soap to make a greasy film that is called **soap scum**. This causes the soap to not bubble as well and makes it harder to rinse off. If you live in an area with hard water, you have probably seen soap scum on the inside of your shower. As you can imagine, soap scum is not something that you want on your clothes.

In this activity, you will investigate why we need to use builders in the detergent. You will see what a difference in bubbles the detergent makes, and be able to compare soap versus detergent in different types of water.

### In this activity we will:



- Use bubbling height to see how hard water affects soap and detergent. You will test both soap and detergent in distilled, hard, and tap water to see if your tap water is hard or soft. You can also make a sliding scale of hard water to determine where how hard different water sources are.

### Safety

Parents, please be careful that your children do not accidentally put soap or detergent into their eyes. If this happens, flush their eyes with lots of water. Powdered soap and detergent can be inhaled which is very painful. Supervise young children when performing this experiment.

### Materials

- Six small jars all of the same size (baby food jars and jelly jars work well)
- Distilled water (can be bought in a grocery store, it is typically used in steam irons)
- Powdered detergent which contains aluminosilicates (Tide works well)
- Powdered soap (Ivory works well – also, Ivory bar soap can be grated to form flakes)
- Epsom salts (to create hard water)
- Tap water
- Measuring spoons (including an 1/8<sup>th</sup> tablespoon measure)
- Measuring cup

- Larger jar for mixing hard water
- A way to mark the smaller jars (grease pencil, labels)
- Ruler (optional)

## **Preparation**

Before the activity, make up a batch of hard water. This can be done by mixing a small amount of Epsom salts (1/8 – 1/4 teaspoon of salt) in distilled water (1-2 cups). Store this in a jar labeled “hard water.”

## **Pre-Activity**

Go over the introduction with children and ask why we need builders in laundry detergent. If you have hard water, look for places where soap scum might occur (shower, around faucets). Talk about why this would be bad for clothes. If you have a water softener, talk about why it is important to soften your water.

## **Activity**

First start by comparing the look of the powdered detergent and the powdered soap. Do they look similar? You will be comparing how well the detergent bubbles in comparison to the soap. Which ever one bubbles more would have less hard water-causing ions in it; remember, hard water causes soap scum which makes it harder for the soap to bubble.

Start your experiment by comparing detergent and soap in distilled water. Distilled water is often used in irons because it does not have as many ions in it as regular tap water. If there are no ions in the water, what do you think will happen with the bubbles? Pour the same amount of distilled water into two of the little jars. Next, put a small amount (~1/8 tsp) of detergent in one jar and label it. Put the same amount of powdered soap in the other jar and label it as well. Hold one jar in each hand and give five sharp shakes to each jar at the same time. Does one have more bubbles than the other one? Does this match your prediction?

Next, do the same thing, only this time use your pre-made hard water. What do you think will happen in this case? Which will bubble better: detergent or soap? Once again, give five sharp shakes to each jar and see how high the bubbles get. (You can use a ruler to measure if you would like to do so.)

Lastly, test your tap water to see if it is hard or not. If it is hard, what will happen to the bubbles in the soap jar? If it is not hard, what will the bubbles in the jars look like? Predict whether you have hard or soft (not hard) water. Put the same amount of tap water into each jar, soap into one, detergent into the other, and give five sharp shakes. How does the bubbling compare? Is your water hard?

## **Summary**

Detergent has a special substance in it called sodium zeolite A which takes the calcium and magnesium ions out of hard water. These ions prevent the soap in the water from bubbling. In the hard water, the detergent should bubble better than the soap. You can determine if your tap water is hard or not by seeing how well soap bubbles in it.

## **Extension**

If you do have hard water (or can get water from different sources such as a stream or lake), you can make a sliding scale of soap bubbles based on the amount of Epsom salts that are in the water. Start with a small amount of Epsom salts in a set amount of distilled water, and see how well it bubbles. Record the bubbling height with the amount of Epsom salts. Add more Epsom salts to the next set amount of distilled water. See how well that bubbles. Continue until you cannot get the soap to bubble at all. Then you can compare your water. Add the same amount of water and soap that you used in your other tests. Shake your jar, and see how high the bubbles go. This will tell you approximately how hard your water is (how many equivalent Epsom salts are in your water)!