Bath Bomb Science

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Experimental Procedure

Bath Bomb Recipes

1. Look at the list of ingredients in Table 1, below, for the two different bath bomb recipes. The total amount for each recipe is approximately 16 tbsp. This should make enough bath bomb mixture to fill three halves of the spherical bath bomb molds for each bath bomb recipe. Be sure to write the recipes down in your lab notebook.

Bath Bomb Recipes									
Recipe Name	Citric Acid	Baking Soda	Cornstarch	Epsom Salt	Food Coloring	Water	Vegetable Oil	Fragrance	Approximate Total
Normal Recipe	3 tbsp.	6 tbsp.	4.5 tbsp.	1.5 tbsp.	5 drops	2.25 tsp.	2.25 tsp.	30 drops	16.5 tbsp.
Extra Cornstarch Recipe	2 tbsp.	4 tbsp.	7.5 tbsp.	1.5 tbsp.	5 drops	5.5 tsp.	2.25 tsp.	30 drops	17.5 tbsp.

Table 1. Each bath bomb recipe here will make enough mixture to fill three halves of the spherical bath bomb molds. Amounts are given in tablespoons (tbsp.) and teaspoons (tsp.).

Making the Bath Bombs

1. Using masking tape or painter's tape and a pen or permanent marker, label two bowls "Normal" and the other two bowls "Extra Cornstarch."
2. In the first "Normal" bowl, mix together the citric acid, baking soda, cornstarch, and Epsom salts by following the normal recipe from Table 1, above. Your bowl

may look similar to the one in Figure 2, below.

Figure 2. When you mix the dry ingredients together (citric acid, baking soda, cornstarch, and Epsom salts), your bowl should look similar to the one shown here.

3. In one of the "Extra Cornstarch" bowls, mix together the citric acid, baking soda, cornstarch, and Epsom salts by following the extra cornstarch recipe from Table 1.
4. You will be making all three normal bath bombs one color, and all three of the extra cornstarch bath bombs another color. This way it will be easy to tell them apart later. Decide which color you want each recipe to be and make a note of your decisions in your lab notebook. The Bath Bomb Kit (http://www.sciencebuddies.org/store-send?url=https%3a%2f%2fwww.homesciencetools.com%2f%3faff%3dSB1) comes with four colors to choose from: red, green, blue, and yellow. You can also choose between two different fragrances: raspberry and vanilla.
5. In the second "Normal" bowl, mix together the food coloring, water, vegetable oil, and the fragrance of your choice by following the normal recipe from Table 1. Add the color you decided on using for the normal recipe. Use a medicine dropper to measure the drops for the food coloring and fragrance. When mixed together, this bowl may look similar to the one in Figure 3, below.
    a. Rinse out and clean the medicine dropper and measuring spoons in between measuring the different ingredients.
    b. Note that these four ingredients will not mix well together because two are water-based (the food coloring and water) and two are oil-based (the vegetable oil and fragrance), but do your best to use a fork and mix them together a bit.

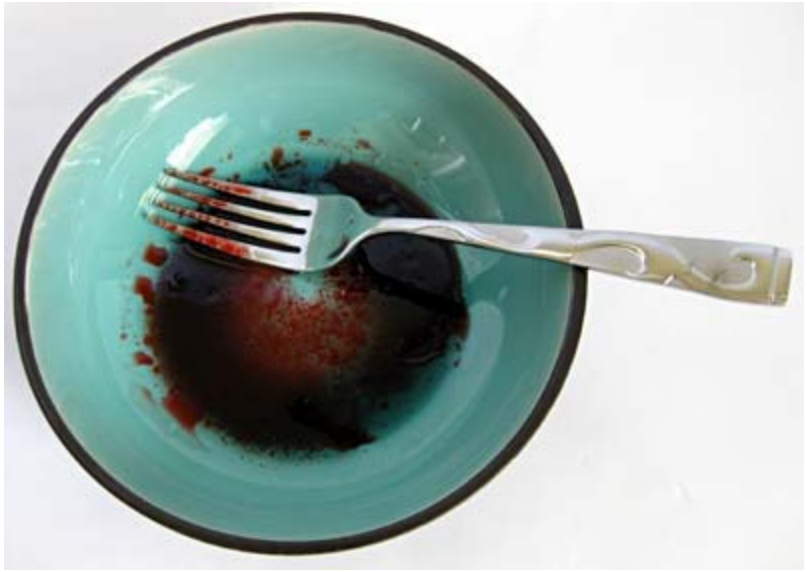

Figure 3. When you mix the water, vegetable oil, fragrance, and food coloring together in the third bowl, it should look similar to this one (depending on what color food coloring you are using).

6. Next you will mix together the wet mixture you made in step 5 with the normal recipe's dry ingredients you prepared in step 2. (Only proceed with this when you are ready, because you will need to do steps 6–8 in one sitting.) This can be tricky to do, so read the following instructions carefully before you start:
    a. Have a clean spoon ready nearby.
    b. Then, using a clean medicine dropper, add a few drops of the wet mixture to the normal recipe's dry ingredients. What happens when you add a drop of the wet mixture? You should see it fizz; this is the bath bomb reaction taking place! Because you do not want the bath bombs to react yet, quickly press down on the fizzy spot with the back of the clean spoon. This should stop the fizzing (and just leave a damp spot).
    c. After you stopped the reaction with the spoon, mix the damp spot in with the rest of the ingredients in the bowl. You want to evenly distribute the moisture as much as you can.
    d. Repeat steps 6.b.–6.c. until your bath bomb mixture has the right consistency. You may not have to use all of the wet mixture. **Important:** Part of the challenge of making bath bombs is adding the right amount of wet ingredients. If you live in a humid environment, you may not need to add all of the wet ingredients. Making bath bombs can be significantly affected by surrounding humidity levels.
        i. If the bath bomb mixture ever appears to continue to puff up and fizz even after you have thoroughly mixed in some wet ingredients, then the mixture may be *too wet* and the bath bombs will not form properly. Instead of trying to "rescue" the mixture, it is best to start over by repeating steps 2, 5, and 6, but this time reduce the amounts of liquid in your recipe. (You can set aside the bowl of "Extra Cornstarch" dry ingredients for later by storing it in a sealable plastic bag.)
            - For example, instead of using 2.25 tsp. of water, you could try using 1 tsp. or 0.5 tsp.
            - You do *not* need to adjust the amount of food coloring, vegetable oil, or fragrance.
            - If you find that the normal recipe works better using less water, you will want to adjust the extra cornstarch recipe similarly. For example, if you ended up using 1 tsp. (instead of 2.25 tsp.) of water in the normal recipe, then use 1.25 tsp. of water less in the extra cornstarch recipe (such as 4.25 tsp. instead of 5.5 tsp.).
        ii. It is also possible to make the bath bombs *too dry*. If the bath bombs are very crumbly, the recipes and bath bomb mixtures may not have enough water in them. The mixture should be damp enough so that it holds shape when you press together small pieces with your fingers. If the bath

bombs are too dry, they will fall apart after they have dried. To fix this, you will need to repeat steps 2, 5, and 6, but adjust the recipes so that they use more water. Getting the amount of water right in bath bombs recipes is a big challenge for making bath bombs, and can depend a lot on surrounding humidity levels.

- For example, if the normal recipe you used included 2.25 tsp. of water, you may want to try repeating it with 3 tsp. of water.
- Again, you do not need to adjust the amount of food coloring, vegetable oil, or fragrance.
- If you find that the normal recipe works better using less water, you will want to adjust the extra cornstarch recipe similarly.

e. When you have mixed the wet and dry ingredients together, your bowl may look similar to the one in Figure 4, below. Quickly go on to the next step so that your mixture does not begin to harden in the bowl.

Figure 4. After mixing the recipe's wet and dry ingredients together, your bowl may look similar to this one.

7. Use a clean medicine dropper to drop one drop of vegetable oil into six halves of the spherical bath bomb molds. Then use a finger to spread the oil all around the surface. Doing this will make it easier for you to remove your bath bombs once they have dried.
8. Take the normal bath bomb mixture you prepared in step 6 and put it in three of the molds. Add a spoonful at a time and use the back of the spoon and/or the palm of your hand to press the mixture down into the hole. It is important to carefully and continually press down hard on the mixture as it is added to the holes so that the bath bombs turn out hard and solid. Evenly divide up the mixture between the three molds, filling them as similarly as you can, as shown in Figure 5, below. *Note:* Do not fill them above the rim, otherwise it will be difficult to remove the bath bombs after they have dried. Also, do not worry if you end up with some extra bath bomb mixture. It is much better to have too much than too little!

Figure 5. Fill up three bath bomb molds using the bath bomb mixture, continually pressing down on the mixture while you fill the mold.

9. Once you have finished your normal recipe batch bombs, continue with the extra cornstarch ones. In the second "Extra Cornstarch" bowl, repeat step 5, but this time mix together the wet ingredients for the extra cornstarch recipe. Use the color and fragrance you decided on using for the extra cornstarch recipe. Be sure to rinse out and clean the medicine dropper and measuring spoon in between measuring the different ingredients.
10. Repeat steps 6–8 using the extra cornstarch recipe ingredients.
    a. Since you already prepared the normal recipe and adjusted the water amounts in the recipes if needed in step 6.d., you should not need to adjust the water amounts again.
    b. Try to fill the bath bomb molds as similarly as possible to how you filled them for the normal recipe bath bombs in step 8.
    c. Do not worry if you end up with some extra bath bomb mixture.
11. Put all bath bomb molds on a plate and let the bath bombs dry.
    a. You can either let the bath bombs sit at room temperature to dry them over night or use the oven. If you use the oven, after it has been preheated to 170° F, turn the oven *off* and put the plate with the bath bombs in. Let them dry in the (turned-off) oven for one hour. *Tip:* If you live in a very humid environment, it is recommended to use the oven to dry the bath bombs after making them to help them dry well.
12. Once the bath bombs have dried, carefully remove them from their molds. They should look similar to the ones shown in Figure 6. You can immediately move on to the next section in the Procedure, *Testing the Bath Bombs,* or you can store the bath bombs in sealed plastic bags until you are ready to test them.

a. If the bath bombs turned out too crumbly, then the bath bomb mixture might have been to dry. You will need to start again by mixing the dry and wet ingredients, but adjust the recipes so that they use more water (see step 6.d.).

Figure 6. After drying the bath bombs and removing them for the mold, they should look similar to these ones.

Testing the Bath Bombs

1. In your lab notebook, make a data table like Table 2, below. You will be recording your data and observations in this data table.

	Trial	Temperature (in °C)	Time to Dissolve (in sec)	Observations
Normal Recipe	1			
	2			
	3			
Extra Cornstarch Recipe	1			
	2			
	3			

Table 2. In your lab notebook, make a data table like this one in which to record your results.

2. Fill a bowl with hot tap water (at least as deep as the height of the bath bombs). Use a metric measuring cup so that you can record exactly how much water you added to the bowl in your lab notebook. Add the same amount each time you fill the bowl.
3. Using a thermometer, measure the temperature of the water. To simulate a bath, you will want the water to be hot, somewhere between 32°Celsius (C) and 43°C (or 90°F and 110°F). Record the exact temperature of the water in the data table in your lab notebook.
    a. If the temperature of the water is too cold to be within the temperature range, empty the bowl and repeat steps 2–3 with hotter water.
    b. *Tip:* To get the water at the temperature you want it to be, try filling the bowl with really hot tap water and then measure the temperature as it cools down until it is within the range you want it to be for your test.
4. Get a stopwatch or timer ready, and if you have a helper, have him or her get ready to time the reaction (i.e., how long it takes a bath bomb to dissolve in the hot water).
5. Drop one of the normal bath bombs into the bowl of water and start the stopwatch right when the bath bomb touches the water. How does the bath bomb react with the water? Observe how the bath bomb dissolves in the water. Record the time (in seconds [sec]) until it has completely dissolved in the data table in your lab notebook as trial 1 using the normal recipe.
    a. It can be tricky to tell exactly when the bath bomb has completely dissolved because the water may become cloudy and the bath bomb may sink. When the bath bomb stops bubbling, check with your fingers, if you can still feel undissolved parts of the bath bomb under the water. Once you do not feel any solid bath bomb pieces anymore, stop the stopwatch.
    b. Record any other observations you make in the data table in your lab notebook.
6. Repeat steps 2–5 using the other two normal bath bombs, one at a time. Use the same amount of water in the bowl each time and make sure the water is within about 0.5°C (or 1°F) (plus or minus) of the original temperature you used. Be sure to record your results in the data table in your lab notebook.
7. Repeat steps 2–6 using the bath bombs made using the extra cornstarch recipe, testing one bath bomb at a time. How does the reaction between these bath bombs and the water compare to the reaction you saw with the normal bath bombs and the water?
    a. Again, make sure the temperature of the water is within about 0.5°C (or 1°F) (plus or minus) of your previous trials.

b. Be sure to record all of your results in your lab notebook.

Analyzing Your Results

1. Calculate the average time to dissolve (in seconds) for each recipe. Record your results in your lab notebook.
    a. For example, if the bath bombs in the three trials using your normal recipe dissolved after 95 sec, 80 sec, and 100 sec, the average time to dissolve would be 92 sec for the normal recipe (since 95 sec + 80 sec + 100 sec = 275 sec, and 275 sec ÷ 3 = 92 sec).
2. Make a bar graph of your results. Put the average time to dissolve (in seconds) on the y-axis (the vertical axis) and the two different recipes on the x-axis (the horizontal axis), making a bar for each recipe.
3. Based on your graph and observations, try to answer the following questions:
    a. Which bath bombs dissolved faster?
        i. What does this have to do with their *reaction rate*? *Hint:* Reread the Introduction in the Background (#background) tab if you need a refresher on what a reaction rate is.
    b. Which recipe made the most impressive bath bombs?
    c. How does having more or less filler (i.e., cornstarch) affect the fizziness of the bath bombs?
    d. Why do you think you got the results that you did?