

Western Engineering Outreach

Fizzy, Scented bath bombs

Grades K-2

Meet Today's ENG HERO!



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Dr. Klinghoffer completed her B.Eng in Chemical Engineering at McGill University, and her M.Sc and Ph.D in Earth and Environmental Engineering at Columbia University in collaboration with Ecole des Mines d'Albi in France. Dr. Klinghoffer is also a faculty member at the Institute for Chemicals and Fuels from Alternative Resources (ICFAR). Her research focuses on catalytic and thermochemical conversion of materials like biomass, waste, and carbon dioxide into valuable products like fuels and chemicals.

To learn more about Dr. Klinghoffer visit:

https://www.eng.uwo.ca/chemical/faculty/klinghoffer_n/index.html

Learning Goal:

- Students investigate the chemical reaction between citric acid and baking soda (sodium bicarbonate)
- Curriculum Connections: Grade 1 - Materials, Objects, and Everyday; Structures: Grade 2 - Properties of Liquids and Solids

Materials Needed:

To make 12 muffin sized fizzes:

- 1 cup baking soda
- $\frac{3}{4}$ cup cornstarch
- $\frac{1}{4}$ cup Epsom salt or cane sugar
- Essential oils (optional)
- Food colouring (optional)
- $\frac{1}{2}$ cup powdered citric acid
 - Lemon juice is a natural form of citric acid so it can be used but the bath bombs won't fizz as much
 - Another option is to try cream of tartar
- Large bowl to mix in
- Measuring cups
- Mixing spoon
- Sifter (optional)
- Spray bottle filled with water
- Something to serve as a mold
 - E.g. silicone molds, plastic eggs, muffin tin lined with saran wrap, etc.



Engineering and Science Connections:

What is chemistry? What is chemical engineering?

Chemistry is a branch of science that studies matter and its interactions. Engineering is the practical application of science and math to solve problems. Chemical engineers work with chemicals. So many everyday things have chemicals in them like medicines, cleaning products, makeup, and artificial flavours. Chemical engineers can work in any of those fields and many others.

The Three States of Matter

Anything that takes up space is called matter. Air, water, rocks, and even people are examples of matter! There are three classifications of matter that are important to understand: solids, liquids, and gases.

A solid is a form of matter that keeps its shape. The molecules in a solid are packed very tightly and close together, which is why solids are so hard! Examples of solids could be a rock or a chair. Can you think of any solids around your home?

Matter in a liquid state moves freely and flows. The molecules in a liquid are still held together by a force of attraction, but not nearly as tightly as a solid. As a result, a liquid will take the shape of its container, unlike a solid. Some examples of liquids could be water or paint. Can you think of any liquids around your home?

Matter in a gas state moves freely and quickly. There is almost no force of attraction between gas particles so the molecules will move freely around any space they find themselves in. Similar to a liquid, a gas also takes the shape of its container. Examples of gases could be air or helium. Can you think of any other gases?

Physical Changes

When a physical change occurs, it does not create a new substance. This means it could be changing the shape or appearance of an object, like crumpling a piece of paper. It can also be a change between states like freezing water to make ice cubes (liquid to solid). Physical changes can be reversed easily.

Chemical Reactions

A chemical reaction is different than a physical change. A chemical reaction mixes two or more substances together (reactants) to form a new substance(s). A chemical reaction is irreversible.

Some of the ways to detect a chemical reaction are: a temperature change, formation of a gas, formation of a precipitate (a solid form from a solution), or a colour change (that is not due to mixing). There are many examples of

chemical reactions in the world all around you. Some specific examples in your home could be, cooking eggs, baking a cake, or having a campfire. Can you think of any other chemical reactions?

Today's Reaction

The reactants in today's reaction are baking soda and citric acid. Baking soda is actually called sodium bicarbonate and it is a base. The bath bombs you will make today mix together baking soda and citric acid (with other things mixed in to add scents, colours, etc.). Because the citric acid and the baking soda are powdered, even when you mix them together, they won't react because they are still in their solid forms. However, when you put your finished bath bomb in the water to use it, the baking soda and citric acid can react. The reaction creates an excess amount of carbon dioxide gas (remember, that was one of the ways to detect if a reaction has happened). This is what creates a fizzy bath bomb!

What is a bath bomb?

People like to put a bath bomb into their bath before they get in. A bath bomb is a mixture of different materials (reactants) formed into a shape of a mold. When a bath bomb is put into water, it starts to fizz (react). The scents and colours you included in the bath bomb are released into the water once the reaction starts.

Video Recommendations: Chemical Changes: Crash Course Kids #19.2

https://www.youtube.com/watch?v=37pir0ej_SE

Activity:

1. Measure out the 1 cup baking soda, $\frac{3}{4}$ cup cornstarch, $\frac{1}{4}$ cup Epsom salts and $\frac{1}{2}$ cup powdered citric acid and mix them together in a large bowl. Note: this recipe is pretty forgiving, so it is a good activity for younger children to try measuring themselves. If you don't have a lot of molds or don't want to make too many bath bombs, try halving the recipe.



2. Fill the spray bottle with water.



3. **Optional:** add several drop of food colouring and/or essential oils to the water in the spray bottle. The food colouring will add colour to your bath bombs. The essential oils will add scent. Both of these additions are optional depending on what you prefer.
4. **Lightly spray the dry mixture with the water from the spray bottle. You want to spray it so that the mixture becomes wet enough that you can clump it together to form the molds but not so much that the mixture loses its fizziness. You will see some bubbles/fizziness because adding water will allow some of the citric acid and baking soda to react, but you don't want it to overfizz.**



5. **Scoop the mixture into the mold you have chosen to use. If you are using a muffin tin, line it with saran wrap before putting the mixture into it so that they are easier to remove later on.**
6. **Press firmly into the molds. Note, when you put the mixture into the molds, it might bubble and overflow, you can just wipe off the overflow with some paper towel.**



7. **Leave the bath bombs out overnight to dry (uncovered).**
8. **Troubleshooting note: if your bath bombs are really dry and crumbly after they have dried overnight, then you probably need to add a little bit more water. Add some more water to the crumbly bath bomb mixture using your spray bottle and then repeat steps 5 to 7 again.**
9. **Gently pop the bath bombs out.**
10. **Store the bath bombs in an airtight container until you are ready to use one in the bath.**

Testing out your bath bomb:

1. **Fill your bathtub with warm water.**
2. **Drop the bath bomb into the water.**
3. **Watch as the bath bomb starts to react! What happens?**

What Did You Learn?



- What is chemistry and chemical engineering?
- What is matter and what are the three states of matter?
- What are physical changes and chemical reactions?

Future Learning



- Experiment with different ingredients e.g. essential oils, colouring, etc. The two ingredients that always have to stay the baking soda and citric acid because without those ingredients, you wouldn't get a fizzy bath bomb!
- Experiment with changing the amount of different ingredients, like the cornstarch for example. How does this impact how fizzy or not fizzy your bath bomb turns out?

Share your creations!

We would love to see what you made. Email us at discover@uwo.ca or tag us on social media.

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Thanks for discovering with us!