Teacher Notes – Bath Bombs

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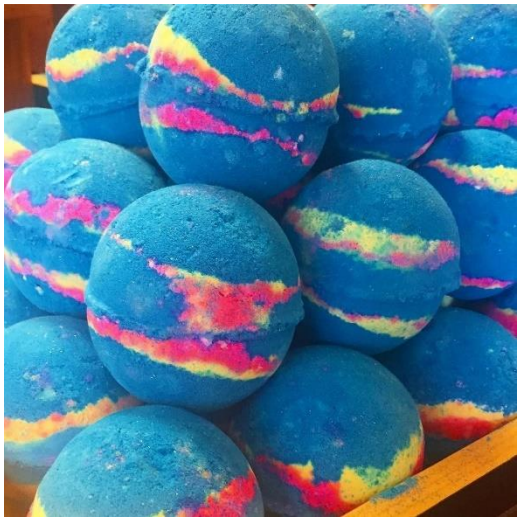

Figure 1 – Bath Bombs

Aim

Turn the laboratory into a small factory and allow your students to engage in a hands-on activity to make their own bath bombs. This is a fun activity and students will learn about a popular type of chemical reaction while gaining the skill of making this popular gift. In this practical, students will experience being artists, designers, perfumers, manufacturers, quality controllers and scientists.

This is a meaningful activity, where the teacher does not need to explain why it is being done. Students can simply give their feedback on the importance of the experiment. It is a learning experience to be valued for the rest of your students' lives.

Plan

Engage students by watching a short clip on how commercial bath bombs may cause skin irritation https://www.youtube.com/watch?v=EOnQ3tZG6II. Follow this by discussing with students if bath bombs are enjoyable and if there is a way to avoid getting a rash. The discussion will eventually lead to the idea of DIY bath bombs, which have known safe ingredients.

Discuss with students the safety issues with the experiment which include:

- Wearing gloves and safety glasses while using chemicals.
- Keeping food colourings away from skin and clothes.
- Avoid eating or tasting the ingredients.

Conduct

The experiment is a mix of prescribed inquiry and open inquiry. Students are given a recipe to follow and they will be asked to analyse and justify their results. However, the teacher can give them the option to add different ingredients in order to achieve certain features such as smell, froth or stress relief. For more advanced classes, the teacher can give them a chance to make changes to the recipe. A useful site to search for DIY recipes is http://www.instructables.com/featured/

The students will mix the ingredients provided in the recipe provided or their own. Care must be taken so that every material used throughout the experiment is dry, otherwise the mixture will fizz before it is made into a bath bomb.

It is important to mix the ingredients well. Students in each group will mix an amount that can make four bombs. Each student will have a chance to make his/her own bomb that they can take home and there is one extra for a trial run.

It is up to students to choose the colour of their bombs. You can provide extra bowls if they want to mix more than one colour. Make sure they mix promptly and fast after adding the oil and food colouring to avoid the onset of a reaction. Students can use scents or essential oils to give their bombs their favourite smells. It is best to try to work the mixture with the fingertips to see if the mixture will stick together. If it is not then add some more oil. Students can add rose petals or other safe additions to their mould while pressing the bomb. Students can wipe some oil around the mould before pressing the mixture into it.

Students will then leave their bombs to set. Somewhere warm is ideal such as near a radiator or a windowsill.

To remove the bomb from the mould, tap the mould with a back of a spoon before removing it. At this point the experiment is done and the students can write their observations and answer the questions provided in the student notes.

However, the teacher can modify the experiment so that students investigate how the recipe could be improved. Following below are some suggestions for extension:

1. ***Changing the amount added of citric acid or bicarbonate of soda***
   In this experiment, students will increase the amounts added of either citric acid or bicarbonate of soda and observe what happens. They can increase the amounts by increments of quarter a cup each time.
2. ***Using cream of tartar instead of citric acid***
   Students will replace citric acid by an equal amount of cream of tartar and observe what happens.
3. ***Compare what happens if the bomb is dropped in cold water and in warm water***
   a. Students will need two similar bombs for this experiment, one is dropped in cold water and the other in warm water. They will need a stopwatch to measure the time taken for each bomb to dissolve, students may record the temperature of the water in each case. It is a good idea to weigh the two bombs and find the time taken to dissolve per gram of bomb by dividing the time taken by the mass of the bomb. The volume of water should be the same.
   b. This part of the experiment could even be extended further to find the relationship between temperature of water and reaction rate. Here it is better if students make small bombs by using a small mould, heat the water and measure the temperature.

They have to use a similar volume of water for each test.

The teacher can discuss with students what the control variables are, the dependent and independent variables in these experiments. Students should make their hypothesis and test it experimentally.

Encourage students to take photos of their experiment and their final product.

Analyse

Depending on which experiment they are conducting, students will choose the best way to analyse their results.

In the main experiment, they will simply write their observations and attach photos to them.

For adding more citric acid or bicarbonate of soda, they may like to tabulate the results as follows:

Amount of citric acid or bicarbonate of soda added	**Observations**

Again, it is a good idea to include photos.

In the experiment of replacing citric acid by cream of tartar, the students can write their observations in a text form or in a table form including photos of both cases.

Substance added	**Observations**
Citric acid	
Cream of tartar	

For part (a) of the comparison between dropping the bomb in cold water and warm water, a table would be perfect for analysis.

Water used	**Mass of ball (g)**	**Temperature of water (^{0}C)**	**Time to dissolve (s)**	**Time/Mass (s/g)**
Cold water				
Warm water				

A similar table for part (b), followed by plotting a graph of time taken to dissolve/mass of bath bomb versus temperature of water.

Temperature of water (^{0}C)	**Mass of ball (g)**	**Time to dissolve (s)**	**Time/Mass (s/g)**

Problem solving and discussion

Students will mention whether their bomb has turned to be as good as they expected and what problems they have faced during making the bomb and how they overcame these problems. A common problem is that the bomb does not set. This could require more time or may be due to not enough wet ingredients, or the students did not loosen it well enough to remove it from the mould. Students can use their critical thinking to confirm the reason why it did not set by comparing what happened to the bombs made from the same mixture by the rest of the group members.

Students will explain the chemistry of the bath bomb. The depth of explanation will depend on the grade level of the students. Simply, this is a chemical reaction between citric acid and bicarbonate of soda which produces carbon dioxide. The release of carbon dioxide is responsible for the fizziness observed. For senior and more advanced classes the explanation is as follows: this is a neutralisation reaction between an acid (citric acid) and a base (bicarbonate of soda which is sodium hydrogen carbonate). The result is a salt (sodium citrate) + water + carbon dioxide. They can express it using a chemical equation:

$$Citric\ Acid + Sodium\ Hydrogen\ Carbonate \rightarrow Sodium\ Citrate + Carbon\ Dioxide + Water$$

$$C_6H_8O_7 + 3NaHCO_3 \rightarrow C_6H_5O_7Na_3 + 3CO_2 + 3H_2O$$

As shown from the equation, the citric acid and sodium hydrogen carbonate react in a ratio of 1:3. For more advanced classes and years 11 and 12, this is called the molar ratio. This leads to the experiment of adding an excess of citric acid or sodium hydrogen carbonate. These two compounds will react until one of them is used up. In this case the excess amount will not react. This would be very clear in the case of using excess sodium hydrogen carbonate because it is insoluble in water but in the case of citric acid it will be hard to observe because it is soluble in water. It will not be observed until the solution reaches a state of saturation where adding more of the substance will not dissolve.

In the case of replacing citric acid with cream of tartar, students should observe less fizziness than when citric acid is used. This is because cream of tartar is an acidic salt of tartaric acid, and this salt is much less acidic than citric acid which makes the reaction less vigorous.

Finally, for comparing the effect of water temperature on the solubility of bath bombs, students will find that the higher the temperature the faster the reaction. As they heat the water, they supply it with thermal energy which helps activate the neutralisation reaction and hence it goes faster.

Students are required to explain the role of each ingredient.

Ingredient	Function
Bicarbonate of soda	This is the base used to react with the acid and release carbon dioxide responsible for the fizziness.
Citric acid	The acid which reacts with the base to produce carbon dioxide.
Baby oil	The wet ingredient which holds the bomb together, it provides a soothing effect on the skin.
Food colouring	To give the ball its preferred colour.
Essential oil (if used)	To add fragrance.
Epsom salt (if used)	Muscle relaxant

Conclusion

Students will confirm if their hypothesis was supported. They can make suggestions for future studies. They can state if the experiment is beneficial, for example is it a skill that they will use in their life? It is a bath bomb of known safe ingredients that will not cause skin rash or inflammation.

They can present their work with all the photos on https://prezi.com or https://www.emaze.com/ or upload it as a YouTube video.

References

Figure 1 https://www.flickr.com/photos/clevrcat/29379074601/in/photolist-DwJJuZ-Gm6mFj-D8xpdY-Csa7QJ-FT8YiE-HcACpd-N3cvgd-LJBNsF-JYJksm-LYYzL9-LYYAob-Mwr2xj-5pda8k-4PQbvM-E4sDKC-4JbMe-4PQdGa-4PUvSj-4PUvpm-4PQetX-A8U5n-4JbHh-9E6MKJ-NvDN6-DDjx4n-4JakP-4PUuBj-4PUshE-4PXUKt-xCD9zR-4JaaH-pU2d3p-4JaXC-6YRWgQ-FnNjJN-RvyzG5-LL8rjZ-NRZz4w-stSiHZ-896iLM-6YRyEW-4QvnJB-4PUvCG-4PQeFK-4PUuMG-4PUurN-2rWG35-KRe9c-4Jbyq-4JafS
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