MAKING AND TESTING BATH BOMBS

There are thousands of hygiene and cosmetic products on the market. All must be formulated and tested before going on sale. For example, hand cream may be tested for viscosity (how thick or runny it is) or the pH of bubble baths might be measured.

Look at the photos on this page. What properties might analysts test in these products?

You're going to make bath bombs and carry out quality tests to ensure they meet specifications.

EQUIPMENT

making bath bombs

- sodium hydrogencarbonate (also called sodium bicarbonate)
- citric acid
- cornstarch
- Witch Hazel (in a pump spray bottle)
- toiletry grade fragrance concentrate
- plastic mixing bowl
- balance to weigh to nearest 0.1 g
- spoon
- five 4 cm diameter spherical two-part rigid moulds (more if you want to make more than five bath bombs)

impact testing

- at least four 'half' bath bombs (made by the same method)
- 20 cm transparent plastic tube (just wide enough to be able to move the mass hanger freely)
- stand and clamp
- 100 g mass hanger with 30 cm length of string tied to it
- 100 g masses
- ruler / tape measure

testing solubility

- four bath bombs
- measuring cylinder
- large beaker
- thermometer
- stirring rod
- kettle
- stopwatch
- Universal Indicator paper






SAFETY NOTES

When making bath bombs, avoid breathing the mixture in as it may make you sneeze. Wear disposable nitrile gloves. When making and testing the bath bombs, wear eye protection. Make sure the plastic tube is securely clamped. When testing solubility, take care pouring boiling water.

METHOD: MAKING BATH BOMBS

1. Wearing eye protection, weigh the following into a plastic mixing bowl and mix well (you can break up any lumps using gloved hands):

   120 g sodium hydrogencarbonate

   60 g citric acid

   20 g cornstarch

   Note: This is enough to make five 4 cm diameter bombs. Increase or decrease the quantities depending on how many you want to make.

2. While stirring the mixture, add 1.5 cm^3 of fragrance concentrate a drop at a time. If you do not stir thoroughly and continuously, the mixture will fizz in the bowl.

3. Continue to stir while spraying Witch Hazel in short sharp bursts until the mixture holds together when pressed in the palm. You are aiming for the consistency of a good sand castle - not too wet, but not crumbling either.

4. For each of three of the spherical moulds:
   a Slightly overfill both halves with the mixture. Push together without twisting them. Set aside to dry for 15 minutes. Do not leave for too long: you will not be able to remove the mould.
   b Carefully remove one half of the mould carefully and leave for a further 10 minutes.
   c Finally, carefully remove the other half of the mould and allow the bath bomb to dry completely (about 1 – 2 hours).

   You will have two bath bombs.

5. For the other two spherical moulds, fill all halves with the mixture and set aside to dry for 15 minutes. Carefully remove the mould and allow the 'half bath bomb' to dry completely (about 1 – 2 hours).

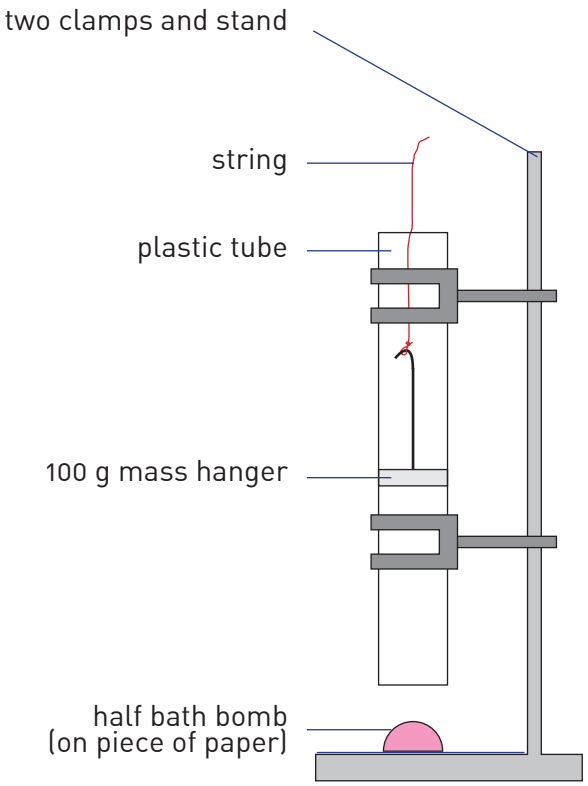
   You will have four 'half' bath bombs.

METHOD: IMPACT TESTING

Bath bombs must be hard enough to be taken out of their packaging and handled without crumbling. The resistance of a material to distortion or damage by squeezing is called its compressive strength.

Use this method to test the four half bath bombs you made.

1. Clamp a plastic tube vertically using two clamps and a stand. Make sure the lower end is 3 cm above the base of the stand. Lay a piece of paper on the base.
2. Mark the tube at 10 cm above the base.
3. Place the half bath bomb on the paper, directly under the plastic tube.
4. Gently lower a 100 g mass hanger into the tube using a piece of string. When it is at the 10 cm mark, release the string. Examine the bath bomb.
5. Pull the mass hanger up and add a 100 g mass. Repeat step 4.
6. Keep adding masses until the bath bomb shows significant signs of crumbling. Record the total mass that has been added.



Note: If possible you could use a digital camera to record the tests.

RESULTS

This is a comparative test. You cannot determine the actual impact strength. However, you can compare the relative strengths of the half bath bombs by recording the masses required to cause significant crumbling.

Collect and tabulate the results of others who made and tested half bath bombs in the same way as you. Choose a suitable way to present the results in a visual form.

CALCULATIONS

- What was the largest mass needed to significantly crumble the half bath bomb?
- What was the smallest mass needed to significantly crumble the half bath bomb?
- What was the range (difference between the largest and smallest mass)?
- What was the mean (average) mass?

METHOD: TESTING SOLUBILITY

Bath bombs should fizz vigorously for a reasonable length of time. Although the optimum temperature for bath water for adults is 45 °C, some people may like hotter or colder baths. Therefore the bath bombs need to perform well over temperatures from 35 to 50 °C.

1. Pour 600 cm^3 of water into a large beaker.
2. Put a bath bomb into the water and stir at a steady rate.
3. Make notes of your observations. Record how long the bath bomb takes to dissolve.
4. Repeat the procedure using water temperatures of (a) 45 °C, (b) 55 °C.

Note: If possible use a digital camera to make a short video of the tests.

RESULTS

Use a table like this.

temperature / °C	observations	time for bath bomb to dissolve / seconds
35		
45		
55		

This is a comparative test. Collect and tabulate the results of others who made and tested bath bombs in the same way as you. Choose a suitable way to present the results.

What differences were there when the bath bombs were put in water of different temperatures?

CALCULATIONS

For each temperature:

- What was the longest time taken for a bath bomb to dissolve?
- What was the shortest time taken for a bath bomb to dissolve?
- What was the range (difference between the longest and shortest time)?
- What was the mean (average) time?

CONCLUSION

Write a brief summary of the outcomes of your investigation.

Comment on the method used to make the bath bombs.

- Which stages were straightforward and which were more difficult (give your reasons)?
- What, if anything, might you change if you made the bath bombs again?

Comment on what happens when bath bombs are put in water.

- Why do they fizz?
- Why do they behave differently in water of different temperatures?

Comment on the results of the tests you carried out.

- How reliable do you think the results were?
- What can you say about the consistency of the properties of bath bombs made using this method?

HEALTH AND SAFETY

A risk assessment must be made before starting any practical work.

When making the bath bombs ensure that all students who have sensitive skin wear gloves and the room is well ventilated as the mixture can cause sneezing. Solid citric acid is an irritant to eyes.

THE INVESTIGATION

In this activity students make some bath bombs and carry out quality tests:

- relative impact strength
- rate at which they fizz and dissolve in water.

SUGGESTED SEQUENCE

Students might work in groups of four, with each group making five bath bombs. Within each group, two pairs could share the tests to be carried out.

Time required

This will require two sessions as the bath bombs should be left to dry for 1-2 hours after moulding.

NOTES

Bathbomb.biz (the company that supplied the method) recommend 'Fine Citric Acid' (powdered citric acid) to achieve a conventional 'smooth' appearance to the bath bomb. However, they also supply 'Granular Citric Acid' (presumably larger crystals) which many people prefer. It is their experience that Granular Citric Acid is less likely to react with the wet ingredients in the mixing bowl thereby making the method a little easier. This is undoubtedly a surface area effect. They go on to say that there is little or no difference in the effect of the bath bomb once in the bath tub. This is probably because once the bomb is made, the surface area for reaction is massively reduced.

INDICATIVE COSTS

The following 2008 prices were taken from http://www.bathbomb.biz/index.html

Sodium hydrogencarbonate	500 g	£1.09
Citric acid	250 g	£1.29
Witch Hazel	100 cm^3	£2.25
Most fragrances	10 cm^3	about £1.75
4 cm diameter spherical mould	5	£2.99

Optional extras:

- colorant (liquid water soluble concentrate, powdered water soluble concentrate or pigment powder colour)
- cosmetic safe glitters
- dried natural flowers/petals.

If one or more of these additional ingredients are used, they should be added after step 1 in the method.

TECHNICIAN EQUIPMENT LIST

per group

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