

The screaming jelly baby

Description

Also known as the 'howling jelly baby' this spectacular demonstration involves the exothermic reaction of a 'jelly baby' with molten potassium chlorate. 15 g of solid potassium chlorate is heated until completely molten and then a jelly baby is dropped into the liquid. The exothermic reaction with the sugar produces a whooshing, whistling sound, clouds of smoke and a bright white flame tinged with violet from the potassium... and a pleasant aroma of caramel.

Preparing and igniting mixtures of sugar and potassium chlorate would be in breach of the Explosives Regulations 2014. However this particular version is an exception.

Jelly babies do contain sugars but in a single lump rather than crystals or powder, thus the surface area exposed (and hence the rate of reaction) is less. In addition, the sugars will be diluted by the water and gelatin present, further reducing the rate of reaction and making an explosion much less likely.

Apparatus and chemicals

- Eye protection
- Safety screens
- Face shield
- Tongs
- Heat resistant gloves
- New borosilicate boiling tube
- Clamp stand
- Bunsen burner
- Heat proof mats

The chemical quantities given are for one demonstration.

- 15 g reagent grade potassium chlorate(V)
- 1 jelly baby

Potassium chlorate(V) is oxidizing, dangerous for the environment and harmful - avoid raising and breathing any dust and keep away from any combustible material or reducing agents.

Procedure

Health & safety

The activity must be carried out only by teachers, who should practice it in advance. They should not be tempted to increase the scale of the experiment.

Make sure that there are no fire alarms that use smoke sensors in the laboratory or, perhaps a more likely scenario, in the corridor if the door is opened to clear the fumes.

Teachers must take steps to prevent theft of the chemicals, in case pupils are tempted to repeat the activity outside school.

This reaction should be carried out in a well ventilated lab - on the open bench with the windows open.

Set up apparatus so tube is pointing away from everyone.

As a precaution in case of explosion, the apparatus should be surrounded on all sides by safety screens – or walls. Do not attempt to enclose the apparatus in any sort of sealed apparatus. Do not use a fume cupboard.

Fume cupboards are not designed to cope with this amount of smoke in such a short time and smoke will leak out. Ejected molten liquids have been known to melt plastic or crack glass windows. The sparks have also been known to ignite the carbon prefilter in recirculatory fume cupboards.

The reaction is very vigorous and the jelly baby, along with molten potassium chlorate(V) and decomposition products may well shoot out of the boiling tube. The safety screens should be arranged to prevent the ejected particles from scattering around the room and especially from landing on combustible objects. There should be enough heat-resistant mats to cover the whole area occupied by the apparatus to protect the bench in case any ejected particles should land on the surroundings.

The jelly baby should not be chopped up. This will increase the surface area and hence the rate of the reaction and the risk of explosion.

Spectators must be several metres away from the demonstration and should wear eye protection.

The demonstrator will, inevitably, be closer to the demonstration than the spectators and should make use of the additional protection provided by a face shield and heat resistant gloves.

The demonstrator's hand is at some risk during the few seconds when the jelly baby is being dropped in to the melt, even if tongs are used. Heat-resistant gloves should be worn.

As impurities can cause an explosion, care should be taken to ensure that the potassium chlorate(V) is pure (use reagent grade) and that the boiling tube is clean (and free, for example, from traces of carbon).

Only use brand new Pyrex or other borosilicate boiling tubes. Use clean tongs to handle the jelly baby.

Clamps used should not have rubber grips, as these may melt because of the heat of the reaction and so permit the boiling tube to move.

Do not substitute sodium chlorate(V) for potassium chlorate(V). It does not work (it has the wrong melting point).

You must not use Gummy bears (or other similar sweets) as these are thought to have caused explosions due to the addition of citric and tartaric acids.

The demonstration

1. Weigh out 15 g of reagent grade potassium chlorate(V) and put into a borosilicate boiling tube.
2. Clamp the tube at about a 60° angle to the vertical. (Sufficiently sloping that the jelly baby will slip down into the molten potassium chlorate).
3. Ensure there are safety screens or walls on all sides and heat the potassium chlorate(V) with a Bunsen burner until it melts.
4. The demonstrator should wear a face shield and heat-resistant gloves. Using tongs, he/she should drop a jelly baby into the liquid (insert jelly baby from the side so as to remove the possibility of molten chlorate splashing on demonstrator's hand, including from ejection of the jelly baby).
5. Increasing quantities or using sodium chlorate can be dangerous and there have been cases reported of explosions when using sweets other than jelly babies.

If any variation from this procedure **is** required, members should contact CLEAPSS or SSERC.

Disposal

Allow apparatus to cool then place tube in a bucket of cold water to dissolve any residues.

If the reaction proceeded satisfactorily and the jelly baby burned fully, there will be very little remaining potassium chlorate. In this case, once the residues from the tube have dissolved in the bucket of water they can be washed to waste with plenty of cold water.

If there is a significant amount of unreacted chlorate, perhaps due to the jelly baby being ejected, the mixture in the bucket should be acidified with some dilute sulfuric acid and then some iron filings or steel wool put in it (about 2 g per g of chlorate). This will result in a solution containing iron II sulfate and potassium chloride which can be safely washed to waste with plenty of cold running water.

After the reaction should any of the mats or safety screens have been splattered with ejected particles of potassium chlorate(V) they should be washed with copious quantities of water and run off down the drain, to prevent the possibility of inadvertent combustion.

Credits

Adapted from procedure by SSERC

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Health & safety checked May 2018

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