LOVE FOOD love SCIENCE

02: LIGHT PRODUCING SUGAR

LOVE FOOD LOVE SCIENCE: LIGHT-PRODUCING SUGAR

What you need:

- sugar cubes
- pliers
- a very, very dark room

What to do:

For this experiment, you will be crushing sugar in the dark • Place your pliers and lumps of sugar where you can easily find them in the dark (it may even be worthwhile to practice crushing sugar before you switch off the lights) • Turn off the light and wait at least two minutes – be patient, your eyes need time to adjust to the darkness • Carefully crush a lump of sugar in your pliers • Watch carefully...

What you may notice:

Hopefully, you should see little flashes of blue light as you crush the sugar

The science behind it all:

The phenomenon you are witnessing is called triboluminescence.
When you crush a lump of sugar, you are fracturing sugar crystals. Although the sugar molecules form an orderly arrangement, the crystals are slightly asymmetric. This allows positive and negative charges to separate from each other as the crystal cracks.

First and foremost, crushing sugar involves energy. The act of simply separating the positive and negative charges takes quite a lot of energy – much like pulling two magnets apart. Think about a rubber band – a rubber band stores energy as you stretch it. This energy builds and builds until you let it go and the rubber band shoots back, releasing all the energy that it took to stretch it in the first place. This is very similar to what's happening with the sugar crystals.

When the two charges eventually shoot back together again, all the energy used to separate them is released and they rip through the air to reunite. As they do this, they are bumping into and exciting nitrogen molecules in the air, causing some of the energy to be released in the form of visible light. Think about triboluminescence as lightning occurring on a smaller scale.

Beyond the science:

Triboluminescence is related to piezoelectricity, the ability of certain materials to produce electricity when under mechanical stress (squeezed, rubbed, etc) due to the separation of positive and negative charges. These materials use vibration from movement to generate electricity and can also change their shape if an electric voltage is applied. Piezoelectric materials generally have an asymmetric shape, allowing for the alteration of electric charge distribution when the molecule is squeezed or stretched. Asymmetric, piezoelectric materials are more likely to be triboluminescent than symmetric ones. However, about a third of known triboluminescent materials are not piezoelectric and some piezoelectric materials are not triboluminescent. Scientists are still trying to figure out what special characteristic determines whether or not a material is triboluminescent.