The Carbon Snake (aka The Black Ooze)

This is a classic demonstration showing the Dehydration of Sugar with Sulfuric Acid. The sugar will turn black and rise out of the beaker in a long snake-like shape releasing heat and dark steam.

Background

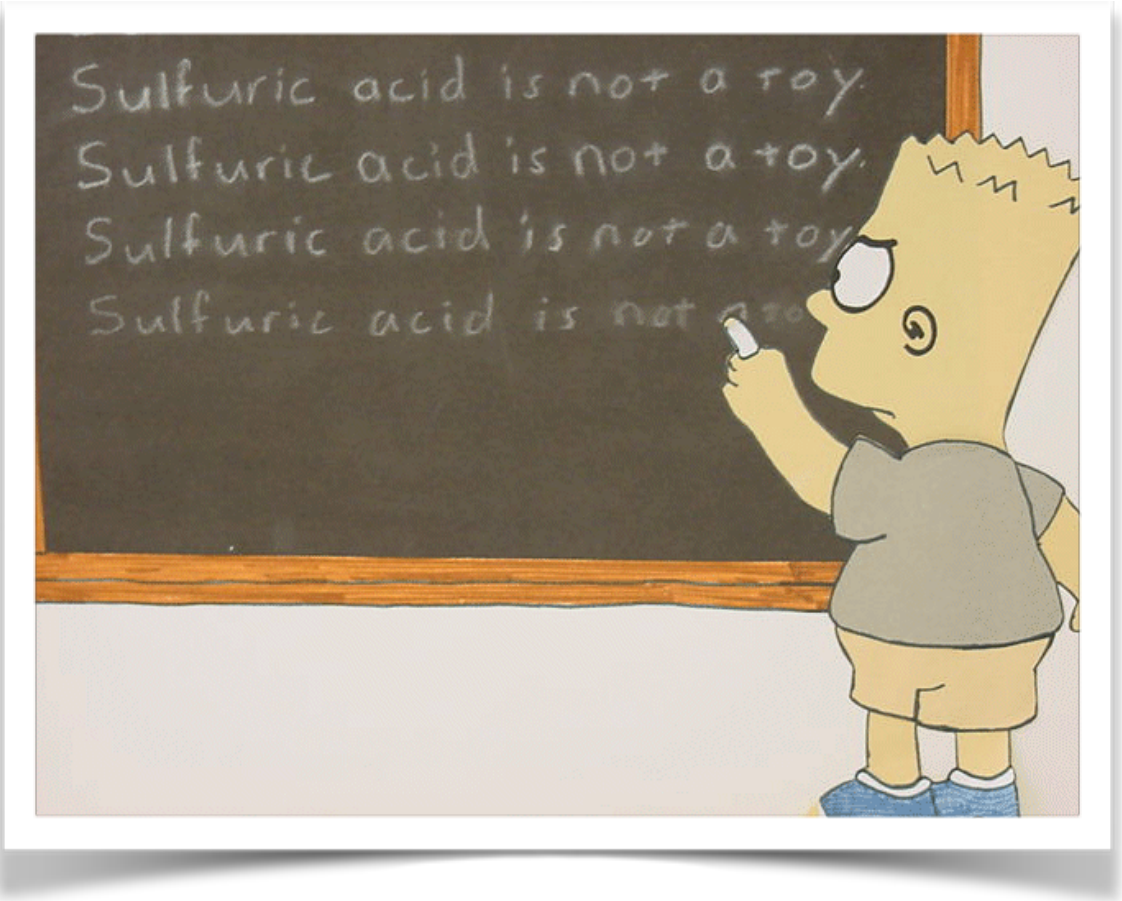
Sugar (sucrose) is a Carbohydrate (made up of Carbon and Water). The Sulfuric Acid acts like a catalyst to help decompose or break apart the sugar into elemental carbon (in the form of a black solid) and water (in the form of steam). A significant release of heat will also take place making this an Exothermic reaction.

Materials:

- 70 grams granulated sugar, $C_{12}H_{22}O_{11}$
- 70 mL of concentrated (18 M) sulfuric acid, H_2SO_4
- 300 mL tall-form beaker
- 40-cm glass stirring rod
- Paper towels
- Disposable gloves or acid gloves
- 100 mL graduated cylinder
- Tray
- 1 liter beaker
- Sodium bicarbonate, $NaHCO_3$
- Spatula

Safety Precautions

Sulfuric acid is a very strong acid and is extremely corrosive to skin. Wear gloves and safety goggles. During the reaction, steam is generated. It is hot. Stand clear of the beaker and reduce amount of contact with these vapors to protect yourself from burns. Fumes are irritating.



Preparation

1. Gather materials needed. You will need a clean beaker for each time you will perform the demo. Beakers can be cleaned and used again. Soak the beaker in soapy water for several hours before cleaning them out.

2. Practice the demo without students present.

Procedure

1. In a well ventilated area (Fume Hood or Outdoors), spread some paper towels on the tray.

2. Put sugar into 300 mL beaker.

3. Insert glass stirring rod into center of sugar (do not use metal as it will react with the acid.

4. Put beaker on paper towels on the tray.

5. Add 70 mL of sulfuric acid to the sugar and stir briefly.

6. Stand about 1 - 2 meters away and wait for reaction to begin and column to grow. Caution: the reaction will generate heat and release a lot of acidic steam.

Disposal / Clean Up

Lift black carbon column from beaker and put it into a liter beaker with some sodium bicarbonate. With spatula, break the column up into smaller pieces. Add a little water and set back on the tray. The foaming action is also exciting. Neutralize any acid spills with sodium bicarbonate and wipe clean. Rinse all glassware and carbon chunks with lots of water. Carbon can be thrown away in trash.

Tips

- Pre measure the 70 mL of concentrated Sulfuric Acid and the sugar into beakers and keep the main containers clear of the demonstration area.

- Wear goggles and gloves.

- Point out the changes taking place as the reaction progresses. First the acid and sugar will turn yellow. Then as the temperature rises it will turn black. Once steam begins to rise it is time to stop stirring and stand back. Chemistry will do the rest!

- If the black carbon never forms a snake shape but rather just bubbles out of the beaker, try using more sugar or less acid. Its up to you if you would like a "Carbon Snake" or a "Black Ooze".