Having a gas with Water

by Eric Muller

Electrocute water and get some gas.

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By building and running a simple electrolysis device, water can be decomposed into its elemental components, hydrogen and oxygen gas. Bubbles emanating from submerged stainless steel electrodes can be collected and tested for their make up.

Materials:
Stainless steel screws at least 1.5" in length – these can be purchased at most hardware stores
Tall plastic bowl or disposable container – such as a Yogurt container, 1 quart or larger size.
Epsom Salt – can be purchased at a drugstore
9-volt battery
Candle – one votive candle
Pots or container to melt the wax
Rubber bands
Paper cup
Oven or microwave
Scissors
Spoon

Optional:
Test tubes – these can be purchased at many drugstores
Matches
Wooden splint or wooden coffee stirrer
Goggles or plastic glasses
Plasticine (an oil based clay)

Assembly:

1. Place the stainless steel screws on top of each battery terminal and perpendicular to the main battery. Both screws should be positioned so that their treads are in contact with the terminals. The heads of each screw should be pointing in the same direction. These screws will be conducting electricity through your device and will also be referred to as electrodes.
2. Make sure the screws are not touching each other anywhere along their length. Wrap rubber bands around the screws and battery so that they stay in place. You may want to wrap several rubber bands around your device and in different directions so that the screws are firmly in place.

3. Your battery and screws will eventually be submerged in a salt solution. The battery terminals and housing need to be protected from corrosive interaction of this solution, but the stainless steel screws must be exposed. The following steps describe how to make a protective coating with candle wax:
   A. Melt some candle wax. This can be done on a stovetop with a double boiler. A double boiler is simply a pot or container situated inside another pot or container filled with water. This allows the wax to heat up without burning.
   C. Lay the battery on top of the wax with the screws point up.
   D. Pour wax on top of the battery. Make sure that the entire battery housing and terminals are coated in wax. The wax should surround the stainless steel screws where they touch

the battery terminals, but do not coat the rest of the screw length.
F. When the wax has solidified, cut the excess paper from above the battery. The more paper you cut the easier it will be to submerge your device in the solution, but leave the portion of cup where the wax is attached to the cup.

Option: Instead of wax, an oil-based clay (plasticine) will work.

4. Fill your plastic 1-quart container half full with luke warm water.
5. Pour Epsom salt crystals into the water. Stir your solution to help dissolve the salt. Pour in salt until it no longer dissolves.
6. Submerge your coated battery and screw device in the salt solution.
7. Your screws should begin emitting bubbles of gas.

Optional - Gas collection
If you want to collect the gasses that come off the device and test their composition, try the options below:

8. Fill a test tube with water. Place your thumb over the open end of the tube and invert the tube in the container. When the covered end is under the solution's surface release your thumb. The water should stay inside the tube.
9. Position the tube so that the open end is resting over one of the screw heads. Make sure that the gas bubbles are able to rise up and collect inside the tube. (Make sure that only bubbles from one screw are collected in each test tube – you do not want to mix gasses!). The screws should be able to support the test tube in a vertical position.
10. Repeat this for the other test tube.
11. Allow this set-up to stand and collect bubbles for several hours or even overnight.

To do and notice:
Did you see bubbles forming at the stainless steel screws? Did one screw emit more bubbles than the other? Look and see which battery terminal is associated with which volume of bubbles.

If you collected the gas in the test tubes, you can check their composition by doing "splint tests". Before undertaking these experiments, read and take heed of the following:
You must work with an adult.
You must use eye protection
You will be working with flames.
Neither test tube should be cracked or chipped.

For the test tube of gas that filled the fastest:

Light your wooden splint on fire. Quickly pull the test tube out of the salt solution and insert the flaming splint into the opening. Hold the test tube firmly, because you might get startled by a loud POP!

For the test tube of gas that filled more slowly:

Again light your wooden splint on fire, but this time, blow out the flame. You should see a glowing ember on the stick. Pull the other test tube out of the water and insert this glowing splint. Again, hold the test tube firmly, because this time you should see

the splint relight. As soon as it relights, pull it out of the tube, blow it out and insert it again. You might be able to get the splint to relight several times.

When you are done, you can pour the salt solution down the drain.

What's going on?

The molecular formula for water is H_2O, where H stands for the element Hydrogen and O stands for the element Oxygen. In a water molecule, the Oxygen atom has a tendency to be negatively charged and the Hydrogen atoms have a tendency to be positively charged. Your device pulled apart water into these two components.

Since opposite charges attract, the Hydrogen migrated towards and bubbled from the negative electrode or stainless steel screw and the oxygen migrated towards and bubbled from the positive electrode or stainless steel screw.

The test tube that made the pop was filled with Hydrogen gas. Hydrogen is the gas that was in the Hindenberg Zeppelin and is very flammable. In its elemental form, Hydrogen gas atoms like to be with other hydrogen atoms, so usually you will see Hydrogen written as H_2 (gas). The other tube where the splint relit, was filled with Oxygen gas, the same gas you breath in order to live and metabolize food. Oxygen gas atoms also likes to exist as diatomic molecules or in a two atoms state, so Oxygen is usually written as O_2 (gas)

(The Epsom salt, also know as magnesium sulfate or $MgSO_4 \cdot 7H_2O$ was dissolved in the water to help your battery break up the water more efficiently. Epsom salt breaks up into particles called ions. When added to the water, these ions help charges move around the solution.).