CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

J0616

Project Title

Which Type of Water Is Better for Electrolysis: Natural or Synthesized Water?

Abstract

Objectives/Goals

The goal of this experiment is to investigate whether naturally-collected waters are better than synthesized salt solutions for water electrolysis. My hypothesis is that those solutions with more salts, such as ocean water and synthesized solutions containing salts, will be more efficient for electrolysis.

Methods/Materials

An electrochemical cell is assembled using nickel electrodes in a beaker of solution and a breadboard circuit connected to two, 9 V batteries, a 1 or 10k Ohm resistor, and a voltmeter. Natural sources of water are collected from the environment (ocean, gutter, runoff, rain, tap, and distilled water) and solutions are synthesized from a variety of salts (NaCl, Epsom salt, and baking soda) in 0.1 M and 1.0 M concentrations. The cell voltage is measured for each solution. The solutions that exhibit the lower voltage drops across the cell are more efficient.

Results

All of the synthesized solutions exhibited cell voltages less than around 3 V. However, most of the natural waters displayed cell voltages greater than 3 V except for ocean water which already contains electrolytes. Results show that the best synthesized solutions are the NaCl solutions and the best natural water is ocean water. The natural waters, i.e. tap, gutter, runoff, rain and distilled, all exhibited much higher voltages (3.6 # 17 V); thus, they are less desirable for electrolysis.

Conclusions/Discussion

My hypothesis was correct. Ocean water and all of the synthesized solutions were better for electrolysis than the remaining natural waters. The former displayed the lowest voltage drops, so they required the least voltage for electrolysis, making them the more efficient solutions for electrolysis. For water electrolysis to become more widespread as a clean, renewable, source of energy to power machines, finding solutions requiring lower cell voltages will be essential. My experiment showed that ocean water and NaCl solutions were the best solutions with the smallest voltage. While making NaCl solutions synthesized in a manufacturing plant would add cost to the technology, ocean water is plentiful as well as free.

Summary Statement

I measured the cell voltage of natural waters & synthesized salt solutions to determine which is more efficient for electrolysis.

Help Received

Dad helped to set up the electronics and built the magnetic stirrer. Mom bought the chemistry supplies and helped to set up the electrochemical cell.