

# Electrolysis Feasibility Testing

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**Objective:** To test how feasible electrolysis is for use as a flow visualization on MSD project P13456.

## Materials Used:

- Power supply
- Multimeter
- Water container
- Water
- Sodium Bicarbonate (Baking soda)
- Aluminum Electrodes – Anode: 5x5cm Cathode: 12x3cm

## Test Setup / Procedure:

1. Fill water container with 7 cups of room temperature tap water.
2. Suspend electrodes in water such that half is submerged and they are set  $\frac{1}{2}$  in apart.
3. Place desired voltage on electrodes.
4. Record current draw.
5. Observe & photograph bubble formation after one minute of operation.

## Results:

The data collected throughout the test is shown in table 1. Figures 1-4 show the bubble formation during the various setups. In total, six setups were tested. Three tests included sodium bicarbonate while the remaining three did not. The electrodes were set to  $\frac{1}{2}$  in apart from one another.

Table 1: Data gathered from electrolysis of various set ups.

|         | Voltage [V] | Current [mA] | Power [W] | Sodium Bicarbonate [Tbsp] |
|---------|-------------|--------------|-----------|---------------------------|
| Setup 1 | 12          | 20           | 0.24      | 0                         |
| Setup 2 | 20          | 40           | 0.8       | 0                         |
| Setup 3 | 24          | 60           | 1.44      | 0                         |
| Setup 4 | 12          | 580          | 6.96      | 1                         |
| Setup 5 | 20          | 780          | 15.6      | 1                         |
| Setup 6 | 24          | 820          | 19.68     | 1                         |



Figure 1: Bubble formation during setup 1. 12V / 20mA



Figure 2: Bubble formation during setup 4. 12V / 580mA



Figure 3: Bubble formation during setup 5. 20V / 780mA



Figure 4: Bubble formation during setup 6. 24V / 820mA



Figure 5: Sodium Bicarbonate build up on the anode after 5 minutes of operation at 24V / 820mA.

### Discussion:

Electrolysis occurred during all setups. Adding 1 tablespoon of the electrolyte (baking soda) increased the current which in affect increased the rate at which electrolysis was happening. The best flow visualization was shown by setup 6 / figure 4. Figure 5 shows the buildup of sodium bicarbonate on the plate after five minutes of operation. This buildup in affect caused the current to eventually drop due to the increase in resistance. Videos have been captured and are shown outside of this document.

The disadvantages observed during testing include the following: the power required for adequate visualization is higher than originally expected, the electrodes must be kept fairly close to one another to maintain electrolysis with good flow (greater distance apart = more resistance), an electrolyte may be necessary for operation to supply good visualization for students, and flow visualization from the top view can be poor at times.

As for feasibility, electrolysis remains a potential flow visualization technique. There are still factors to consider. This test only tested aluminum as an electrode and with no motion of water. Further testing should include electrolysis while fluid is in motion to better understand and visualize what students will be viewing.