SEA WATER AS A POTENTIAL ELECTROLYTE IN BATTERY POWER CELL

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ABSTRACT

This project is to find the best solution of seawater as an electrolyte in battery cell for power generation. In order to generate power source, method of electrolysis was applied by using Aluminium and Copper as the negative and positive terminals respectively, the solution of sea water as an electrolyte and Copper (II) sulphate (CuSO₄) as an additive. There were three conditions of experiment that were carried out, the i) changing size of Aluminium strips and Copper strips, ii) changing volume of seawater iii) different amount of Copper (II) sulphate (CuSO₄). In the first condition, the result showed that the bigger the size of Copper strips, the higher the current value produced. While in the second condition, there was not much effect produced in current and voltage values. In the third condition, the addition of CuSO₄ gave a large positive impact on the power cell. Judging by this experiment, it is decided to inject some amount of CuSO4 in the electrolysis. The main reason of injecting CuSO₄ into the electrolysis in order to boost up the current value. Thus, the results showed that the combination of abundant amount of seawater with limited amount of Copper (II) sulphate solution (CuSO₄) as an alternative source for future power cell generation.

Key words: Electrolysis, Seawater, Copper, Aluminium, Copper (II) sulphate, Power sources
1.0 INTRODUCTION

Electricity is one of those discoveries that have changed the daily life of everybody on the planet. Electricity is the key component to modern technology and without it most of the things that we use everyday simply could not work, and would never have been created. Our mobile phones, our computers, the internet, our heating systems, our televisions, our light bulbs nearly everything in the home would be completely different. There would be completely different systems put in place in the home to ensure that we can remain warm, and to ensure that we can live properly every day.

In many countries electricity can only be used for a few hours a day which effects many people around the world who live in these areas, there economy’s just cannot afford to run their power plants for long periods at a time. Many of these people have to use candles and oil lamps just to be able to eat or to read a book. We have given away much of our technology to help many of these people, But there are still thousands of cities all over the world that cannot afford to build such machines or they cannot get the parts.

The study of application of seawater as an electrolyte for deep seawater-activated batteries have been done for many years (Shinohara M et. al. 2007; Shen P. 7 et al. 1994; Wales C. 7 et. al. 1975; Crompton T. 2000). Highly active anode magnesium has been used in the cells in order to produce high power (Kobashi H. et al 2013; Renuka R. 1999; Hasvold O & et al. 1997; Yu K. & et. al. 2011). However, seawater is yet not being widely utilized as a source of power energy due to weak electrolyte. Thus more studies are required to enhance seawater as a strong electrolyte in electrical power production.

This is why we have introduced our new power cell. It is a cheap alternative energy source for people to use. Even if they built small cheap water batteries, these small batteries can still be used for low lighting which is better than nothing. We did a few research and created new product about power cell in order to generate electricity. Our main project is to produce new environmental friendly power cell
which will be tested in the small electrical powered car (Figure 2). Copper strip and aluminium plate were used as electrodes and sea water as an electrolyte.

Copper strip acted as cathode (positive charge) and aluminium plate as anode (negative charge). The chemical reaction was as follows:-

The chemical reaction is:-

Cathode :- (Reduction)

\[ \text{Cu}^{2+} + 2e^- \rightarrow \text{Cu} \]

Anode :- (Oxidation)

\[ \text{Al} \rightarrow \text{Al}^{3+} + 3e^- \]

Overall:-

\[ 3\text{Cu}^{2+} + 3(2e^-) \rightarrow \text{Cu} \]
\[ \text{Al} \rightarrow \text{Al}^{3+} + 2(3e^-) \]
\[ = \text{Al} + 3\text{Cu}^{2+} + 6e^- \rightarrow 2\text{Al}^{3+} + 3\text{Cu} + 6e^- \]
\[ = 2\text{Al} + 3\text{Cu}^{2+} \rightarrow 2\text{Al}^{3+} + 3\text{Cu} \]

1.1 Problem Statement

According to current projection we have maximum of 50 years of petroleum reserve left. In response of warnings, more research on alternative power source are demanding. So introducing our new aluminium copper power cell hopefully could contribute to more the power source in the future. This project is to find the best solution of seawater as an electrolyte in battery cell for power generation. In addition, our new power cell can reduce the cost production of power cell. The material used is easy to find on the market and the cost is cheaper than the expansive branded battery.

2.0 OBJECTIVES OF THE STUDY

The objectives of this project are:-

a) To produce new power cell which is environmentally friendly.
b) To determine that aluminium and copper can generate power with using sea water as an electrolyte.

c) To observe the effect of copper (II) sulfate as an additive in the electrolyte.

3.0 METHODOLOGY

The method used in this project was by conducting electrolysis of aluminium and copper based on design as in figure 2. The main components used in this method were aluminium and copper as the negative and positive terminals respectively. The solutions used as the electrolyte were seawater and seawater + copper (II) sulphate. In this project, there were three experiments being conducted i) changing the size of aluminium and copper, ii) changing the volume of sea water, iii) adding copper (II) sulphate in sea water.

4.0 RESULTS AND DISCUSSION

Figure 2 shows the results of voltage and ampere with different type of copper and aluminium using sea water only. It shows that, the greater the size of copper and aluminium, the greater the current. The voltage obtained is 0.4V (Table 1).
Figure 2: A Graph of current against size of copper and aluminium

Table 1: Voltage and ampere production with different size of copper and aluminium

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Anode</th>
<th>Cathode</th>
<th>Electrolyte</th>
<th>Size (cm) (Length x Width)</th>
<th>Voltage (V)</th>
<th>Current (A) (without load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aluminium</td>
<td>Copper</td>
<td>Sea Water</td>
<td>3 X 0.7</td>
<td>0.4</td>
<td>0.010</td>
</tr>
<tr>
<td>2</td>
<td>Aluminium</td>
<td>Copper</td>
<td>Sea Water</td>
<td>3 X 1.4</td>
<td>0.4</td>
<td>0.015</td>
</tr>
<tr>
<td>3</td>
<td>Aluminium</td>
<td>Copper</td>
<td>Sea Water</td>
<td>3 X 2.1</td>
<td>0.4</td>
<td>0.025</td>
</tr>
</tbody>
</table>

The graph shown in figure 3 shows the Ampere production with different volume of seawater. It shows that there is no different in the current and voltage production by changing the volume of seawater (Table 3).
**Figure 3:** Ampere production with different volume of seawater

**Table 2:** Ampere production from different volume of seawater.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Anode</th>
<th>Cathode</th>
<th>Electrolyte</th>
<th>Volume (ml)</th>
<th>Size (cm) (Length x Width)</th>
<th>Voltage (V)</th>
<th>Current (A) (without load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aluminium</td>
<td>Copper</td>
<td>Sea Water</td>
<td>5</td>
<td>3 X 2.1</td>
<td>0.6</td>
<td>0.025</td>
</tr>
<tr>
<td>2</td>
<td>Aluminium</td>
<td>Copper</td>
<td>Sea Water</td>
<td>10</td>
<td>3 X 2.1</td>
<td>0.6</td>
<td>0.025</td>
</tr>
</tbody>
</table>

The graph shown in Figure 4 shows the comparison of the electrolyte used during the experiment in order to determine which electrolyte is more excellent. It shows that, with adding small amount of copper (II) sulphate will increase the current from 0.025amp to 0.065amp. The voltage production obtained by adding copper(II) sulphate is 0.5V (Table 3).
Figure 4: Ampere production comparison of two electrolyte; seawater only and seawater + copper(II) sulphate.

Table 3: Voltage and ampere production from two different electrolyte (one cell)

<table>
<thead>
<tr>
<th>Size (Length X Width)</th>
<th>Current (Amp)</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>seawater only</td>
<td>seawater only</td>
</tr>
<tr>
<td>3 X 1.4</td>
<td>0.015</td>
<td>0.4</td>
</tr>
<tr>
<td>3 X 2.1</td>
<td>0.025</td>
<td>0.4</td>
</tr>
</tbody>
</table>

5.0 CONCLUSION

Based on the result obtained it can be concluded that by adding a small amount of Copper (II) sulphate solution (CuSO₄) into the seawater solution is the best idea as it produces high values of current. In the meantime, it also increases the reading of voltage. By comparing the results where the copper and aluminium emerged into the seawater alone, the result obtained was dramatically less than the electrolyte injected with CuSO₄. Based on second experiment that had been conducted, it can be justified that by changing volume of seawater did not give any significant effect on voltage and current values. As seawater is abandon and free as compared to Copper (II) sulphate solution (CuSO₄), hopefully this finding will be
beneficial in the development of seawater power cell. In the future, in order to earn more reliable results, more experiments have to be carried out. With this positive results, more experiment can be done in the future driving towards better power cell.

REFERENCES


