THE UTILIZATION OF SEA WATER IN A ESPECIALLY DESIGNED BATTERY (SABRINE SWALL BATTERY)

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Abstract

Batteries are chemical devices to save electricity. device capable of generating a DC voltage, ie by converting chemical energy contained in it into electrical energy through the reaction of electro clams, Redox (Reduction - Oxidation). The battery consists of several cells, these cells become energy storage in the form of chemical energy. Negative electrode called the cathode, which serve as electron donors. Positive electrode called the anode which serves as an electron acceptor. Between the anode and the cathode current will flow from the positive pole (anode) to the negative pole (cathode). While the electrons will flow from ktoda toward the anode.

In this study, the batteries are designed to use sea water as electrolyte. Voltage measured for one cell is 0,75 Volt and measurable current of 100mA, to get the required voltage is 10 Volts 15 cells arranged in series. Testing is done by loading a flashlight with 5 LED, the results of this special design battery capable of powering 5 LED for seven days without stopping, this suggests that there are large energy stored in batteries. After charging the battery energy runs out of energy again just by replacing the sea water as electrolyte. These batteries are designed to be placed in the beach area and waterfront, it is intended that the sea water needs as the electrolyte can be easily obtained. The especially designed battery is one of the low technology and easy to be made, because the necessary materials readily available in the manufacture of batteries, the battery does not require extra maintenance, environmentally friendly and can be used for twenty-four hours as long as there is sea water.

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1. Introduction

New and renewable energy at the present time is not bizarre and it's commonly heard. Almost all of the countries in the world today are competing to do the research for new and renewable energy development in an effort to face energy crisis in the future due to the decreasing amount of energy derived from fossil along with the increasing energy needs of everyone. Not only due to the increasing energy needs alternative energy resulted increasingly in demand but also the green energy as an alternative energy does not give harmful effects on people and the environment like the fossil energy that produce emissions / exhaust gases that endanger the survival of all creature on this earth.

Indonesia certainly as a country and has large residense is not devoid to do something in facing the threat of energy shortages and damage to Earth's upper atmosphere. President of the Republic of Indonesia in the G-20 forum in Pittsburgh, United States (2009) states that Indonesia could reduce emissions of combustion for energy by 26% and reached 41% by 2020 (Djadjang Sukarna, 2011). However, the development and utilization of renewable energy in Indonesia is not widely utilized, it due to the high cost of installation like solarcell, and needs especially operation and maintenance. In addition to these economic factors should be knew that generated electricity by utilizing new and renewable energy is energy resource that never runs out, saving electricity costs in a long run, clean and friendly environment, contribute to reduce global warming, practically does not require treatment, to avoid the impact of power outages (from PLN) due to energy limitations.

The first electrochemical cell was developed by the Italian physicist Alessandro Volta in 1792, and in 1800 he invented the first battery, a "pile" of many cells in series. Daniell cell in 1836, batteries provided more reliable currents and were adopted by industry for use in stationary devices, in particular in telegraph networks where they were the only practical source of electricity, since electrical distribution networks did not exist at the time.

In 1859 the French physicist Gaston Planté invented the first rechargeablebattery. This secondary battery was based on *lead–acid (LA) chemistry*, a system that is still used today. In 1899 the Swedish Waldmar Jungner invented the *nickel–cadmium (NiCd) battery*, based on nickel for the positive and cadmium for the negative electrode. Two years later, Edison came up with an alternative design by replacing cadmium with iron. Due to high material costs relative to dry cells or LA storage batteries, the practical applications of nickel–cadmium and nickel–iron batteries were limited. In 1932 Schlecht and Ackermann invented the sintered pole plate with which great improvements were achieved. These advancements were reflected in higher load currents and improved longevity. The sealed nickel–cadmium battery, as we know it today, only became available in 1947, when Neumann succeeded in completely sealing the cell. Soon after the discovery, in the late 1960s, that intermetallic compounds, such as $SmCo_5$ and $LaNi_5$, were able to absorb and also desorb large amounts of hydrogen, it was realized that electrodes made of these materials could serve as a new electrochemical storage medium. In the following years the hydrideforming electrode proved to be a serious alternative to the cadmium electrode, which was widely employed in rechargeable nickel–cadmium batteries. In particular, the higher energy storage capacity, good rate capability and non-toxic properties of the chemical elements of which these hydride-forming materials were composed were great advantages in relation to the cadmium electrode. The *nickel–metal hydride (NiMH) battery* became commercially available in the 1990s. The first non-rechargeable *lithium batteries* appeared in the early 1970s. Attempts to develop rechargeable lithium batteries followed in the 1980s but failed due to safety problems. Because of the inherent instability of lithium metal, especially during charging, research shifted to intercalate lithium ions in host materials in Li-ion batteries. Although lower in energy density than lithium metal, lithium ion is safe, provided certain precautions are taken when charging and discharging, implemented by means of a proper charging algorithm and a safety IC in series with the battery. In 1991, the Sony Corporation commercialised the first *lithium-ion battery (Li-ion)*.

Zainal, Robby Rahmatul Hamdi dan Nur Wahid (2010) from ITS Surabaya are ordering seawater to fisherman in Indonesia. They use Sea Water Galvani Cell technology (SWALL) to convert seawater to alternative fuels. In "The alternatif Energy Competition Indonesian Mechanical Innovation Challenge 2010 Surabaya, this research reach second level.

2. Research Methodology

Initial Study, Experiments and Data Collection

The data that required and collected are:

a. Voltage magnitude of the experimental results
b. The amount of current from the experiment results
c. The amount of power from each experiment with a variety of materials

Data Analyzed

Researchers conducted an analysis of data already obtained in item one above as the basic steps for planning a battery which will be made. As for the analysis carried out to obtain some of the following :

1. Potential difference, current and power
2.Kind of electrode to be used in the manufacture of battery
3.The shape of the battery will be designed
4. The series of battery cells

Battery Model Design

Design is based on data that has been analyzed, using the equations and conditions that have been described on theorytical basis.

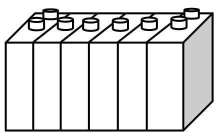

Figure 1 Battery Designed

Manufacture of Battery

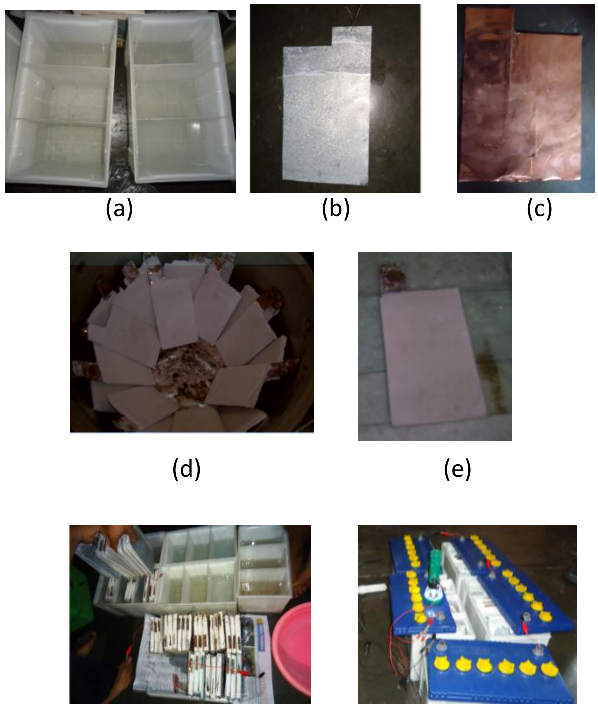

Figure 2 Manufacture of Battery

Testing of battery

After battery was made, it tested to obtain the data potential difference, current, power and energy from the battery.

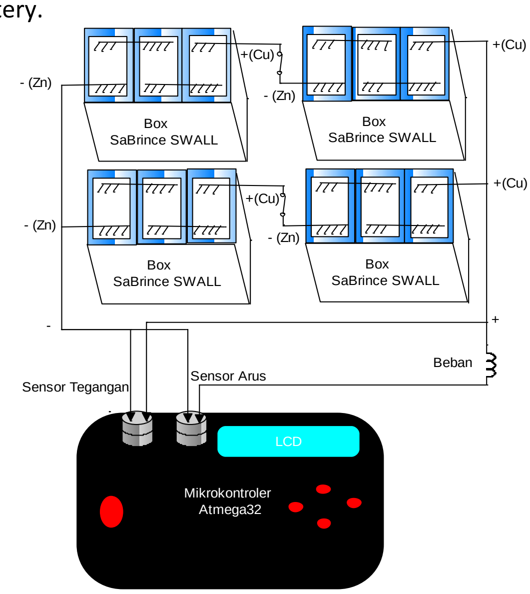

Figure 3 Testing scheme of current and potential difference censor by microcontroler on SaBrine SWALL

3. Results of Research

Potential difference is measured by using a microcontroller atmega32 to each cell is 0,75 Volt and the current measured using a microcontroller atmega32 15 mA. 15 battery cells arranged in series obtained measurable voltage of 10 Volt.

Once the battery is made with a load testing of a flashlight that has 5 pieces of LED in it.

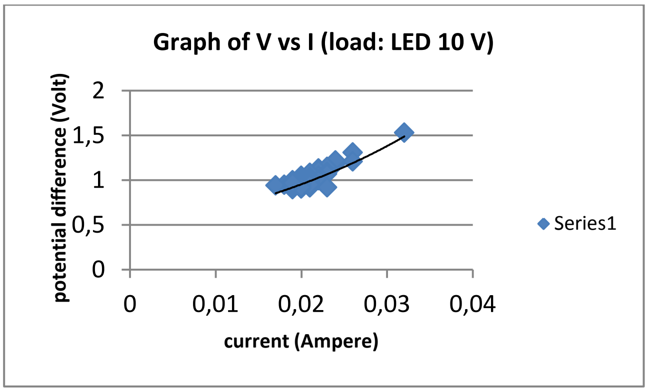

Figure 4 SaBrine SWALL charesteristic (LED 10 V)

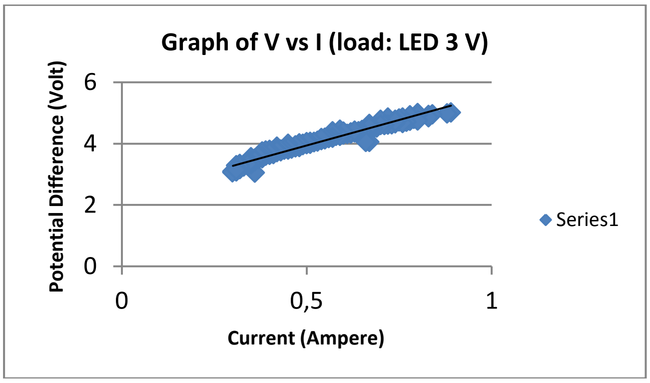

Figure 5 SaBrine SWALL charesteristic (LED 3 V)

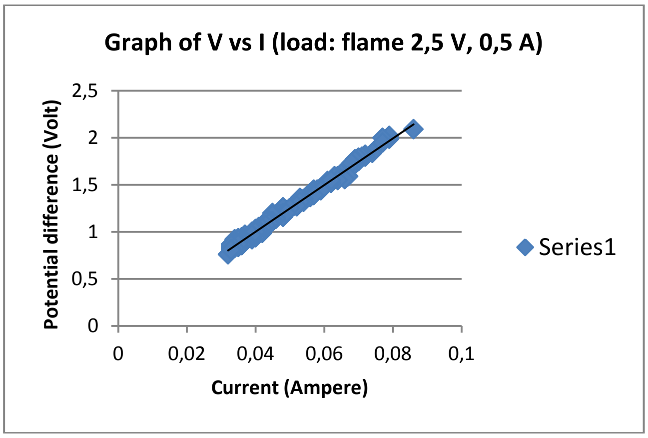

Figure 6 SaBrine SWALL charesteristic (flame 2,5V, 0,5A)

Energy is the amount of power being generated to one unit of time.

$$E = V \times I \times t$$

where

E : Energy (Watt Hour)

V : The amount of voltage (Voltage)

I : The amount of current (Ampere)

t : Time (Hour)

in this research, data capture data capture as much as 10 times for each collection consists of 241 data stored, in order to obtain the data quite well. The data we are using logaritmic analysis and correlation of data in order to obtain experimental data close to 1 for the correlation. Table 1 and figure 7 below shows the amount of energy battery for 296 hours:

Table 1 Amount of energy battery

No	Time (Hour)	Energy (Watt Hour)
1	1	3.98685
2	2	3.55515
3	3	3.40256
4	4	3.04561
5	5	2.79864
6	6	2.57954
7	7	2.28994
8	8	2.12425
9	9	1.95880
10	10	1.83975
11	11	1.69760
12	12	1.58171
13	13	1.49273
14	14	1.40156
15	15	1.29021
16	16	1.22888
17	17	1.16474
18	18	1.09561
19	19	1.02868
20	20	0.96388
21	21	0.02805
22	22	0.02178
23	23	0.02034
24	24	0.02000
25	25	0.01912
26	26	0.01853
27	27	0.01848
28	28	0.01842
29	29	0.01900
30	30	0.01900
31	31	0.01895
32	32	0.01897
33	33	0.01924
34	34	0.01885
35	35	0.01936
36	36	0.01921
37	37	0.01879
38	38	0.01885
39	39	0.01863
40	40	0.01814
41	41	0.13974
42	42	0.10557
43	43	0.08819
44	44	0.07580

Table 1 (continued)

No	Time (Hour)	Energy (Watt Hour)
45	45	0.06574
46	46	0.05856
47	47	0.05266
48	48	0.04658
49	49	0.04377
50	50	0.04001
51	51	0.03818
52	52	0.03660
53	53	0.03470
54	54	0.03240
55	55	0.03211
56	56	0.03125
57	57	0.03044
58	58	0.02922
59	59	0.02838
60	60	0.02723
61	61	0.06098
62	62	0.03879
63	63	0.03254
64	64	0.02838
65	65	0.02690
66	66	0.02477
67	67	0.02297
68	68	0.02169
69	69	0.02060
70	70	0.01942
71	71	0.00132
72	72	0.00141
73	73	0.01725
74	74	0.01689
75	75	0.01597
76	76	0.01527
77	77	0.01529
78	78	0.01459
79	79	0.01391
80	80	0.01360
81	81	0.02211
82	82	0.01338
83	83	0.01134
84	84	0.01088
85	85	0.01053
86	86	0.01043
87	87	0.01021
88	88	0.00868
89	89	0.00821

Table 1 (continued)

No	Time (Hour)	Energy (Watt Hour)
90	90	0.00865
91	91	0.00799
92	92	0.00901
93	93	0.00870
94	94	0.00838
95	95	0.00842
96	96	0.00828
97	97	0.00840
98	98	0.02070
99	99	0.00813
100	100	0.00654
101	101	0.00603
102	102	0.00545
103	103	0.00464
104	104	0.00422
105	105	0.00406
106	106	0.00405
107	107	0.00407
108	108	0.00393
109	109	0.00363
110	110	0.00351
111	111	0.00378
112	112	0.00356
113	113	0.00341
114	114	0.00322
115	115	0.00337
116	116	0.00321
117	117	0.00330
118	118	0.03461
119	119	0.01554
120	120	0.01033
121	121	0.00876
122	122	0.00835
123	123	0.00704
124	124	0.00700
125	125	0.00666
126	126	0.00631
127	127	0.00629
128	128	0.00609
129	129	0.00566
130	130	0.00547
131	131	0.00520
132	132	0.00529
133	133	0.00484
134	134	0.00467

Table 1 (continued)

No	Time (Hour)	Energy (Watt Hour)
135	135	0.00456
136	136	0.00460
137	137	0.00426
138	138	0.02267
139	139	0.00840
140	140	0.00472
141	141	0.00429
142	142	0.00351
143	143	0.00319
144	144	0.00296
145	145	0.00281
146	146	0.00268
147	147	0.00256
148	148	0.00250
149	149	0.00244
150	150	0.00236
151	151	0.00225
152	152	0.00227
153	153	0.00216
154	154	0.00219
155	155	0.00226
156	156	0.00228
157	157	0.00224
158	158	0.00358
159	159	0.00218
160	160	0.00214
161	161	0.00212
162	162	0.00209
163	163	0.00212
164	164	0.00209
165	165	0.00193
166	166	0.00196
167	167	0.00196
168	168	0.00184
169	169	0.00177
170	170	0.00172
171	171	0.00177
172	172	0.00167
173	173	0.00179
174	174	0.00176
175	175	0.00175
176	176	0.00176
177	177	0.00183
178	178	0.01713
179	179	0.01317

Table 1 (continued)

No	Time (Hour)	Energy (Watt Hour)
180	180	0.00894
181	181	0.00480
182	182	0.00305
183	183	0.00328
184	184	0.00260
185	185	0.00225
186	186	0.00191
187	187	0.00184
188	188	0.00176
189	189	0.00176
190	190	0.00192
191	191	0.00184
192	192	0.00168
193	193	0.00070
194	194	0.00074
195	195	0.00002
196	196	0.00014
197	197	0.00114
198	198	0.00154
199	199	0.00130
200	200	0.00146
201	201	0.00140
202	202	0.00111
203	203	0.00096
204	204	0.00096
205	205	0.00125
206	206	0.00111
207	207	0.00107
208	208	0.00096
209	209	0.00093
210	210	0.00091
211	211	0.00083
212	212	0.00070
213	213	0.00065
214	214	0.00069
215	215	0.00076
216	216	0.00070
217	217	0.00070
218	218	0.00068
219	219	0.00068
220	220	0.00063
221	221	0.00073
222	222	0.00070
223	223	0.00068
224	224	0.00044

Table 1 (continued)

No	Time (Hour)	Energy (Watt Hour)
225	225	0.00029
226	226	0.00032
227	227	0.00026
228	228	0.00036
229	229	0.00099
230	230	0.00099
231	231	0.00080
232	232	0.00065
233	233	0.00073
234	234	0.00059
235	235	0.00057
236	236	0.00052
237	237	0.00083
238	238	0.00083
239	239	0.00073
240	240	0.00080
241	241	0.00073
242	242	0.00073
243	243	0.00080
244	244	0.00083
245	245	0.00070
246	246	0.00073
247	247	0.00058
248	248	0.00060
249	249	0.00050
250	250	0.00057
251	251	0.00046
252	252	0.00052
253	253	0.00075
254	254	0.00065
255	255	0.00073
256	256	0.00073
257	257	0.00077
258	258	0.00068
259	259	0.00070
260	260	0.00075
261	261	0.00073
262	262	0.00086
263	263	0.00078
264	264	0.00073
265	265	0.00068
266	266	0.00070
267	267	0.00068
268	268	0.00068
269	269	0.00070

Table 1 (continued)

No	Time (Hour)	Energy (Watt Hour)
270	270	0.00063
271	271	0.00075
272	272	0.00070
273	273	0.00065
274	274	0.00065
275	275	0.00057
276	276	0.00059
277	277	0.00054
278	278	0.00063
279	279	0.00070
280	280	0.00065
281	281	0.00063
282	282	0.00058
283	283	0.00065
284	284	0.00068
285	285	0.00077
286	286	0.00077
287	287	0.00068
288	288	0.00070
289	289	0.00070
290	290	0.00068
291	291	0.00065
292	292	0.00070
293	293	0.00068
294	294	0.00059
295	295	0.00068
296	296	0.00065

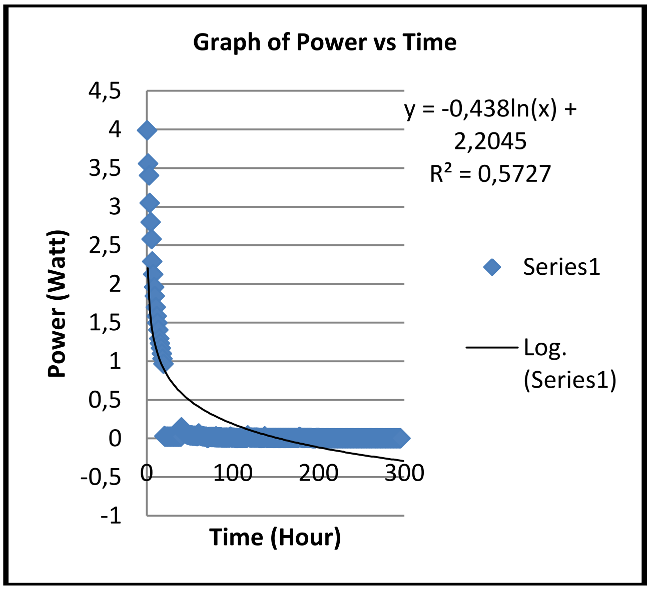

Figure 7 Graph of Power vs Time

The amount of energy can be determined by solving the equation on the graph above with the integral method.

$$y = 0{,}43\ln(x) + 2{,}204$$

$$E = L = {}_{10}^{296}\, 0{,}43 \ln x + 2{,}204$$

$$= 0{,}43[(x.\ln(x)\text{-}x)] + 2{,}204 \,.\, x \,\Big|_0$$

$$= 0{,}43[(296 \,.\, \ln(296) - 296)] + 2{,}204 \,.\, 296$$

$$= 724{,}2689 - 127{,}29 + 652{,}384$$

$$= 1.249{,}3629 \text{ Watt Hour}$$

4. Discussion

Salt Bridge Membrane Sea Water Galvanic Cell (SaBrine SWALL) application is an electrochemical energy power that lasts for 24 hours non-stop. The results of this energy can be used directly or stored in the battery, terms of direct use energy in order to survive longer with LED lamp load.

Electrode materials used in SaBrine SWALL using copper (Cu) and zinc (Zn) as an alternative to the first industrial scale, because it is easy to find.

For that second alternative use Cu and Zn metal material as the electrode. In its development, the researchers was addicting the membrane as a protective method of corrosion, rust, and can increase the electrical conductivity (EC) of the sea water. In this research reported that water testing is put into the sea before and after use SWALL Sabrine, DHL has increased from 35 650 to 40 450 µmhos / cm. Seawater used in the electrolyte SaBrine SWALL increased by 4800 µmhos / cm

5. Conclusion

1. Sea water is one of the electrolyte solution that can be used as an electrolyte in the battery.
2. In addition to Pb, Copper and Zinc covered by a membrane may be a good electrode in an electrolyte battery with sea water.
3. By using a microcontroller atmega32, battery voltage magnitude can be determined with sea water as electrolyte.
4. The energy generated by the battery electrolyte seawater for 296 hours amounted to 1.249,3629 Watt Hour.

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