International Journal of Scientific and Technical Research in Engineering (IJSTRE)
www.ijstre.com Volume 8 Issue 1 ǁ Jan-Feb 2023.
ISSN: 2581-9941

Utilization of Salt Water as an Alternative Energy Source

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***Abstract**: This study examines how much influence the salt content of the voltage and current generated by the electrolyte cells using copper and zinc electrodes. This study aims to determine how much influence the salt content of the voltage and current produced by salt water and sea water and also to determine the comparison of voltage and current produced by sea water Padang Beach with salt water produced CV. Prosperous Farming. In this study using a copper plate electrode as the anode and zinc plate as the cathode, with each electrode cross-sectional area of 135 cm2, in this study menggunanakan 4 pieces of cells in rangakai in series. In general, there are four stages in this study, starting from the stages of conducting literature studies, making experimental tools, data retrieval and data analysis. The salt content is very influential on the voltage and current produced, in addition to the salt content of the water volume also affects the voltage and current produced. Where the salt water solution in getting the highest voltage is the volume of water 1500 ml with a salt content of 6 ppm in seawater the highest voltage in getting the volume of water 500 ml with a salt content of 33 ppm. Salt water solution with a voltage of 3.64 V and a current of 0.004 A is able to turn on the LED lamp for approximately 12 hours and seawater solution with a voltage of 2.81 V and a current of 0.002 A is able to turn on the LED lamp for 4 hours*

***Keywords:** salt content, water Volume, voltage and current.*

I. Introduction

Electrical energy is one of the very important energies in our daily lives, with the increasing development and increasing population, the level of consumption of electrical energy consumption has also increased(Usman, Hasbi and Sudia, 2017). Be it the use of electricity for households, social interests and industrial needs. Currently the source of electrical energy that we use is still dependent on energy supply from the government, most of its energy sources still rely on non-renewable natural resources(Murah and Soepomo, 2014). Therefore, we must create renewable and environmentally friendly sources of electrical energy.

In modern times today there are many who do the development of alternative energy sources that are renewable and environmentally friendly as a substitute for Petroleum and fossils. Some of the energy sources that are being developed are such as wind power plants, solar power plants, sea waves, hydro power, geothermal, and one of the energy sources whose existence is very abundant on Earth is salt water(Prastuti, 2017)

We can use salt water as an alternative energy source to produce renewable and environmentally friendly electrical energy. That's because in the salt water there is a high content of sodium chloride (NaCl) elements and by water (H_2O) in the breakdown into Na^+ and Cl^- (free particles), in the presence of free particles that the onset of electric current(engineering et al., 2017). Therefore, the authors want to conduct research on how much influence the salt content of the voltage and current generated by salt water and sea water using copper and zinc electrodes. Based on the above statement, the authors want to conduct further research with the title "study analysis of the use of salt water as an alternative energy source" by conducting this research is expected to help the wider community and living in coastal areas to utilize sea water as an electrolyte solution to generate electricity and become an innovation of alternative renewable energy sources in the future.

II. THEORETICAL

2.1 Salt Water As Electrolyte Solution

Salt is usually used as a flavoring in food, and everyone already knows that. At this time there have been many who do research, where the research is about an innovation or renewal as well as salt that we know only as a flavoring ingredient in food, at this time no longer only as a flavoring in food but also used as a solution that produces electrical voltage. Salt is one component of the chemical part because salt consists of strong acids and strong bases that are neutral and have a neutral pH of 7. Water is a chemical substance with the chemical formula H_2O, a water molecule composed of two hydrogen atoms covalently bonded to one oxygen atom (Park et al., 2016). Electrolysis of water is the decomposition of water compounds (H_2O) into oxygen (O_2) and hydrogen gas (H_2) by using electric current through the water. In this research we use copper electrode as cathode and zinc electrode as anode. At the cathode, two water molecules react by capturing two electrons that are reduced to H_2 gas and hydroxide ions (OH^-). While at the anode, two other water molecules break down into oxygen gas (O_2) and release 4 H ions and electrons to the cathode. H ions and OH-undergo neutralization so as to re-form some water molecules, hydrogen gas and oxygen resulting from this reaction to form bubbles on the electrode. The breakdown of the ions contained in the NaCl salt water solution can produce electrical energy. This is because NaCl is made up of Na^+ ions and Cl^- (free particles) that generate electricity.

NaCl salt solution will become electrolyte :

$$NaCl_{(\square)} \rightarrow Na^+ + Cl^- \text{……………………………………………………….... …….(2.1)}$$

2.2 electrode

Electrodes are conductors that are passed by electric current from one point to another. Electrodes can be of several different shapes including wire, plate, and more. And most electrodes are made of metals, such as copper, silver, lead or zinc. However, it can also be made of non-metallic electrical conducting materials, such as graphite. If in the case of direct current (DC) electricity, these electrodes must be paired or known as the anode and cathode or positive and negative poles. The cathode is defined as the electrode where the current leaves and the anode as the point where it returns, for a more historical scientific reason that electricity is described as moving from positive to negative. In accordance with the agreement, the cell potential (**E°** red) is a combination of the cathode of the cathode of the cathode of the cathode of the cathode of the cathode of the cathode of the cathode of the cathode of the cathode of the cathode of the cathode :

$$E^\circ{}_{\square e \square} = E^\circ \text{ katoda} - E^\circ \text{ anoda} \text{...… … … … . . . (2.2)}$$

The standard reduction potential (**E°** red) of each electrode can be seen in the following table of standard reduction potential :

Table 2.1 Reduction Potential Table

Half Reaction	**E°(V)**
Ag+ (aq) + e– ⇌ Ag(s)	+0,80
Fe3+(aq) + e– ⇌ Fe2+(aq)	+0,77
I2(s) + 2 e– ⇌ 2 I– (aq)	+0,54
NiO2(s) + 2 H2O + 2 e– ⇌ Ni(OH)2(s) + 2 OH– (aq)	+0,49
Cu2+((aq) + 2 e– ⇌ Cu(s)	+0,34
SO4 2– (aq) + 4 H+ (aq) + 2 e– ⇌ Ni(OH)2(s) + 2 OH– (aq)	+0,17
AgBr(s) + e– ⇌ Ag(s) + Br– (aq)	+0,07
2 H+ (aq) + 2 e– ⇌ H2(g)	0
Cd2+(aq) + 2 e– ⇌ Cd(s)	-0,40
Fe2+(aq) + 2 e– ⇌ Fe(s)	-0,44
Cr2+(aq) + 3 e– ⇌ Cr(s)	-0,74
Zn2+(aq) + 2 e– ⇌ Zn(s)	-0,76
2 H2O + 2 e– ⇌ H2(g) + 2 OH– (aq)	-0,83
Al3+(aq) + 3 e– ⇌ Al(s)	-1,66

If the solution is not in the standard state, then the relationship between the cell potential ($E_{\square e \square}$) and the standard cell potential($E^\circ{}_{\square e \square}$) can be expressed in the following Nernst equation :

$$E_{\square e \square} = E^\circ{}_{\square e \square} - \left(\frac{R.T}{n.f}\right) \text{In } Q \text{ ....(2.3)}$$

Description :

E □e□ = Cell potential at nonstandard state

E°□e□ = Cell potential at Standard State

R = Gas Konstanta ideal = 8,314 J/ mol.K

T = Absolute temperature (K) [in this case, we use the room temperature, 25 ❸ C or 298 K]

n = Number of moles of electrons involved in redox

F = Konstanta faraday = 96500 C / F

Q = Ratio of product ion concentration to reactum ion concentration

2.3 Concentration Of Solution

The concentration of the solvent is the ratio of the amount of solute to the solvent or solution. Where in the research that will be done later using mineral water as a solvent and kitchen salt as a dissolved substance. To determine the concentration of an electrolyte solution can be found by the equation formula below.

The formula for calculating the concentration of the solution is as follows:

$$M = \frac{m}{Mr} \times \frac{1000}{V} \quad \text{.......} (2.4)$$

Description :

M = concentration of solution (mol)

Mr = Relative Mass

m = mass of solute (grams)

V = volume of solution (ml)

2.4 Light Emitting Diodes (LEDs)

Light Emitting Diode or often abbreviated as LED is an electronic component that can emit monochromatic light when given a forward voltage, each color LED (Light Emitting Diode) will require a forward voltage (Forward Bias) to be lit. The forward voltage for the LED is relatively low so it requires a resistor to limit the current and voltage so as not to damage the LED in question(Mujadin and Rahmatia, 2018).

The formula for finding the resistance of LEDs is as follows :

$$R = \frac{(V_s - V_1)}{I} \quad \text{.......} (2.5)$$

Keterangan :

R = resistor value (ohms)

V□ = input voltage (volts)

V□ = voltage on the LED (volts)

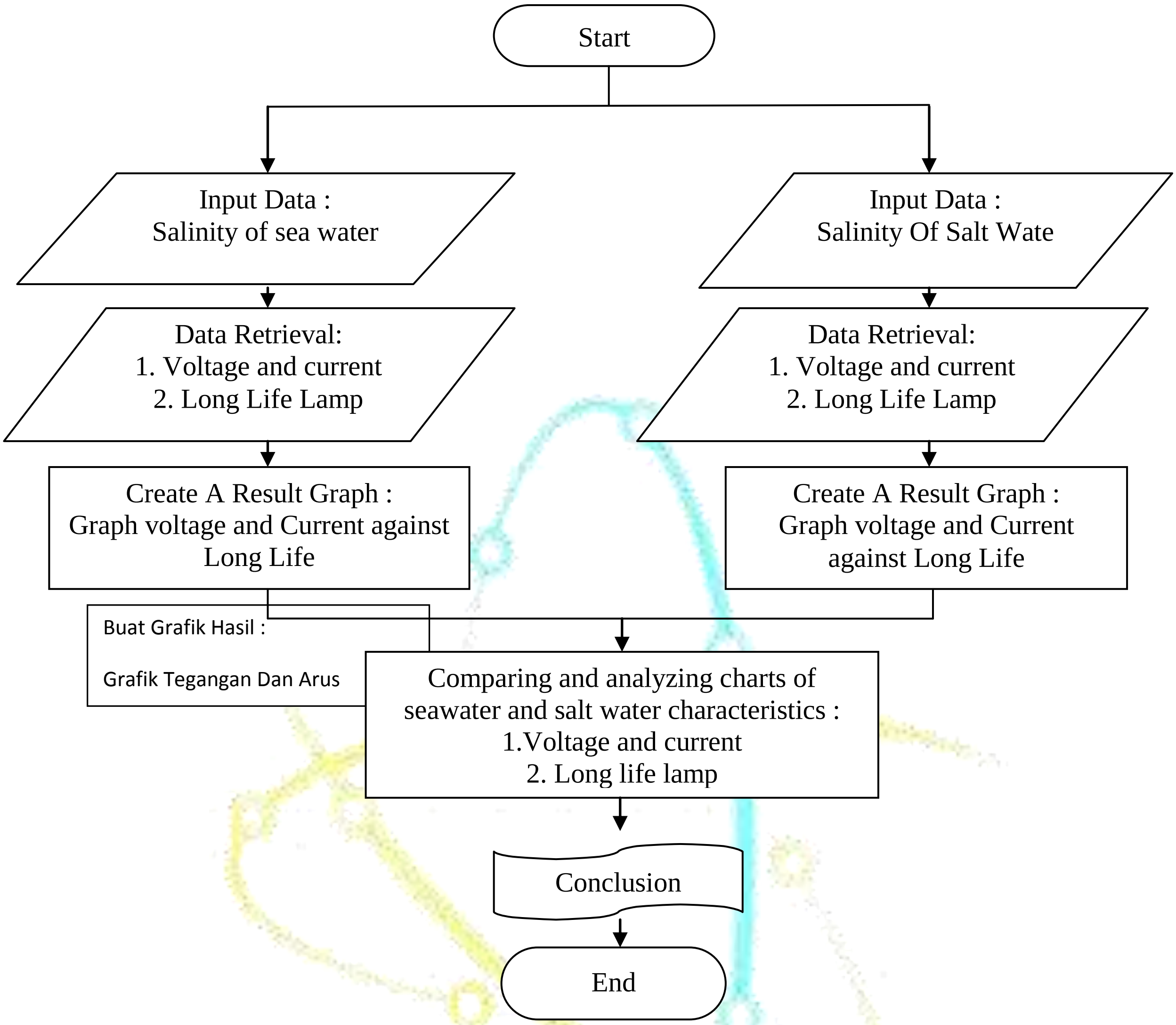
I = LED forward current (amperes)

III. Research Methods

This study was conducted by experimental methods using simple electrical circuits, tools and materials used in this study are, salt, mineral water, sea water, copper electrodes (cathode), zinc electrodes(anode), refractometer, AVOmeter, digital scales, led lights and jumper cables.

The data obtained by testing directly on the electrolyte cells by varying the salt content and also the volume of water. The required Data are current, voltage, and salt content.

3.1 Flowchart



Gambar 3.1 Flowchart Penelitian

3.2 Research Circuit

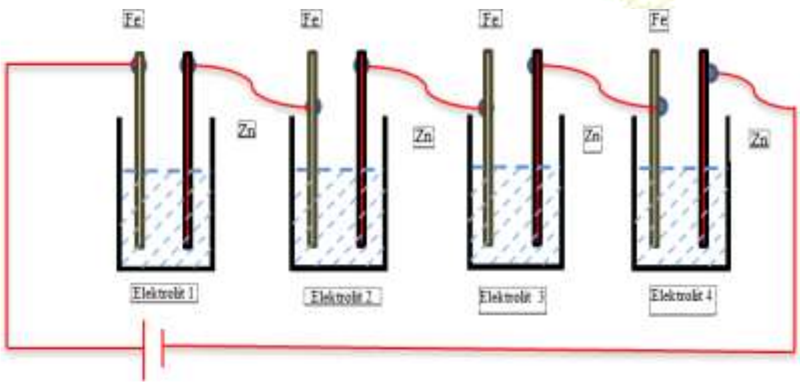


Figure 3.2. Research Circuit [8]

IV. Results And Discussion

Table 4. 1 Salt Water electrolytic cell testing with 500 ml water Volume

No	Salt Mass (gr)	Salinity (ppm)	Concentration (mol)	Voltage (V)	Current (A)
1.	10gr	18	0,34	3,46	0,008
2.	20gr	36	0,68	3,22	0,008
3.	30gr	53	1,02	3,15	0,012
4.	40gr	70	1,36	3,06	0,011
5.	50gr	87	1,70	3,05	0,011
6.	60gr	95	2,05	2,95	0,01

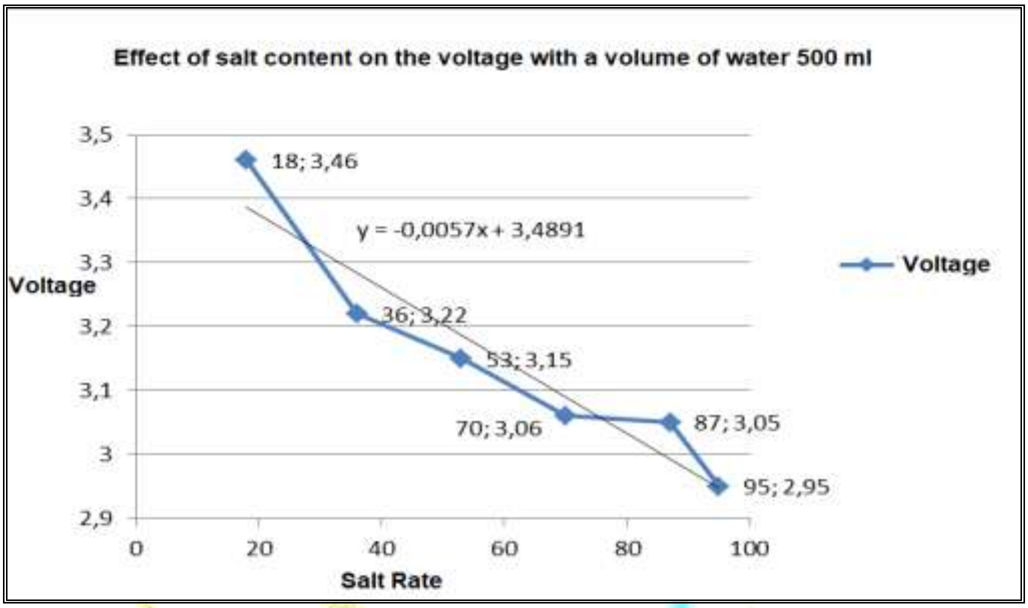


Figure 4.1 effect of salt content on the voltage with a volume of water 500 ml

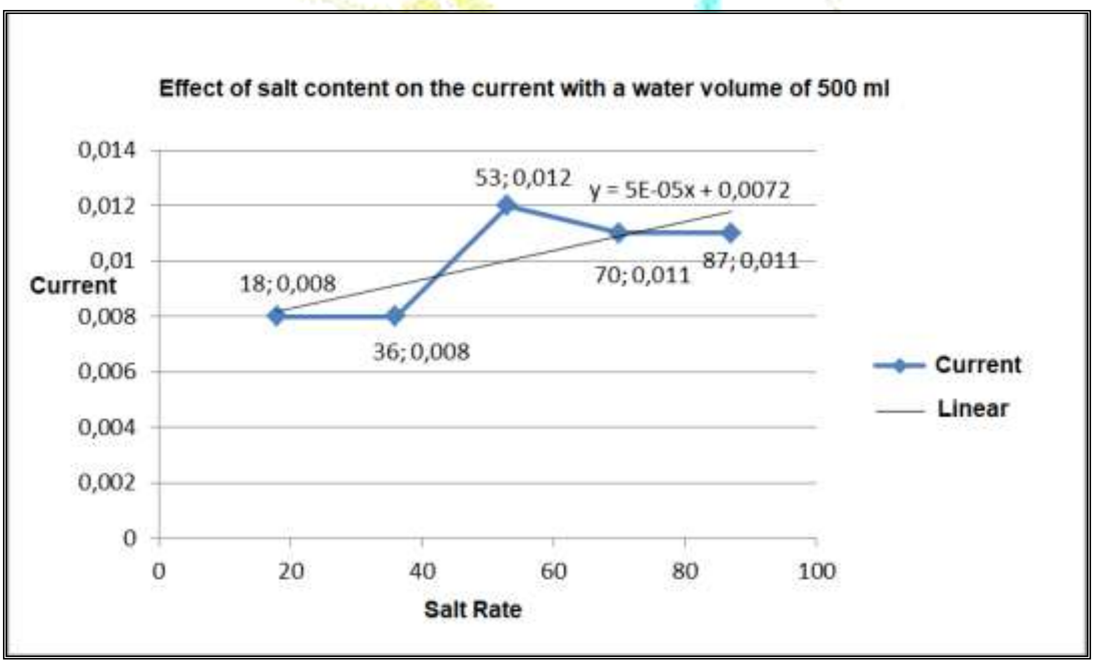
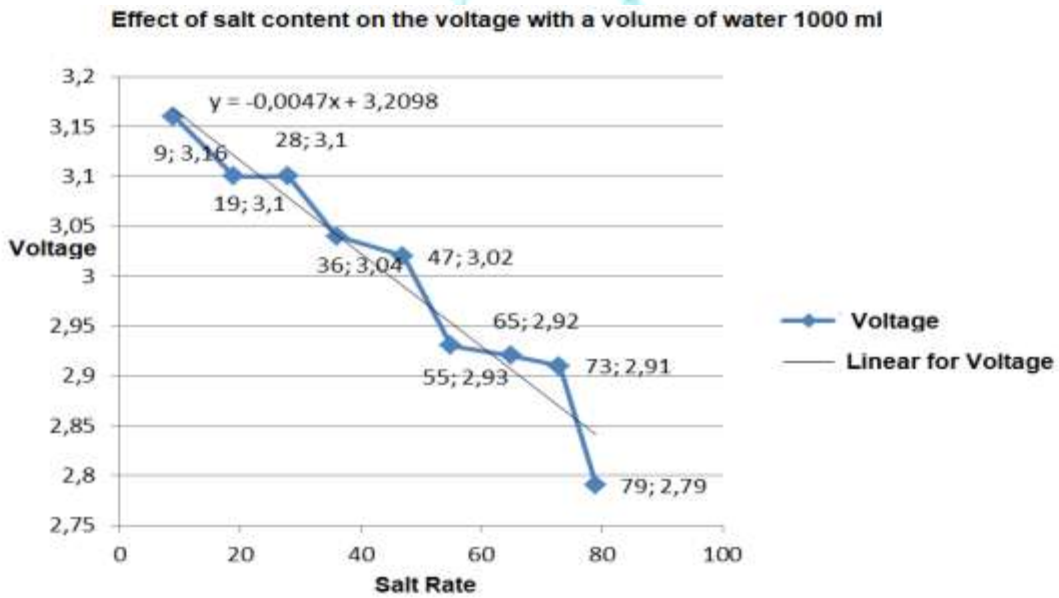


Figure 4.2 comparison of salt content to the current with a volume of water 500 ml

Table 4.2 electrolyte cell test result Data with 1000 ml water volume

No	Salt Mass (gr)	Salinity (ppm)	Concentration (mol)	Voltage (V)	Current (A)
1.	10 gr	9	0,17	3,16	0,012
2.	20 gr	19	0,34	3,10	0,012
3.	30 gr	28	0,51	3,10	0,011
4.	40 gr	36	0,68	3,04	0,010
5.	50 gr	47	0,85	3,02	0,011
6.	60 gr	55	1,02	2,93	0,010
7.	70 gr	65	1,19	2,92	0,010
8.	80 gr	73	1,36	2,91	0,009
9.	90 gr	79	1,53	2,79	0,007
10.	100 gr	87	1,70	2,82	0,008
11.	110 gr	94	1,88	2,81	0,008



Picture 4.3. Effect of salt content on the voltage with a volume of water 1000 ml

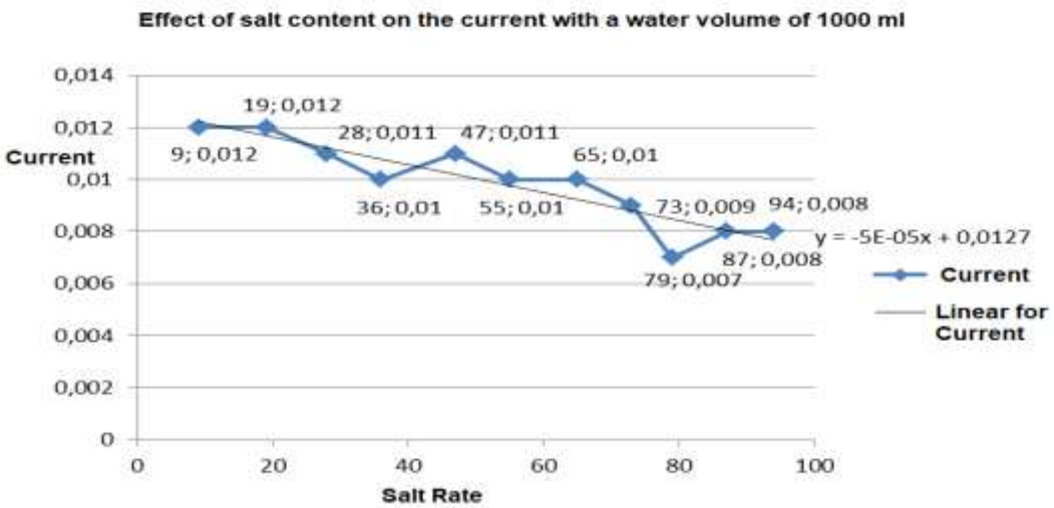


Figure 4.4 effect of salt content on the current with a volume of water 1000 ml

Table 4.3 electrolyte cell test result Data with 1500 ml water volume

No	Salt Mass (gr)	Salinity (ppm)	Concentration (mol)	Voltage (V)	Current (A)
1.	10 gr	6	0,11	3,64	0,004
2.	20 gr	13	0,22	3,45	0,003
3.	30 gr	18	0,34	3,36	0,003
4.	40 gr	25	0,45	3,27	0,003
5.	50 gr	30	0,56	3,21	0,003
6.	60 gr	36	0,68	3,18	0,003
7.	70 gr	43	0,79	3,17	0,002
8.	80 gr	48	0,91	3,12	0,003
9.	90 gr	54	1,02	3,13	0,003
10.	100 gr	59	1,13	3,09	0,003
11.	110 gr	65	1,25	3,08	0,002
12.	120 gr	71	1,36	3,05	0,003
13.	130 gr	76	1,48	3,05	0,003
14.	140 gr	81	1,59	3,00	0,002
15.	150 gr	86	1,70	3,01	0,002
16.	160 gr	92	1,82	3,00	0,002
17.	170 gr	97	1,93	2,98	0,002

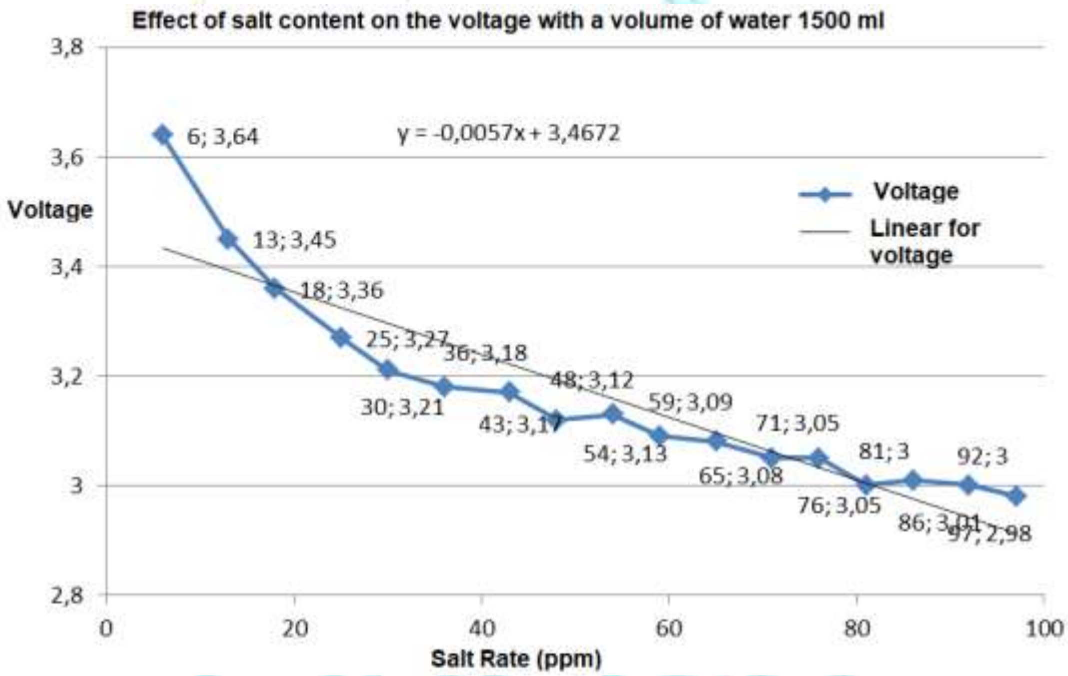


Figure 4.5 comparison of salt content to voltage with water volume 1500 ml

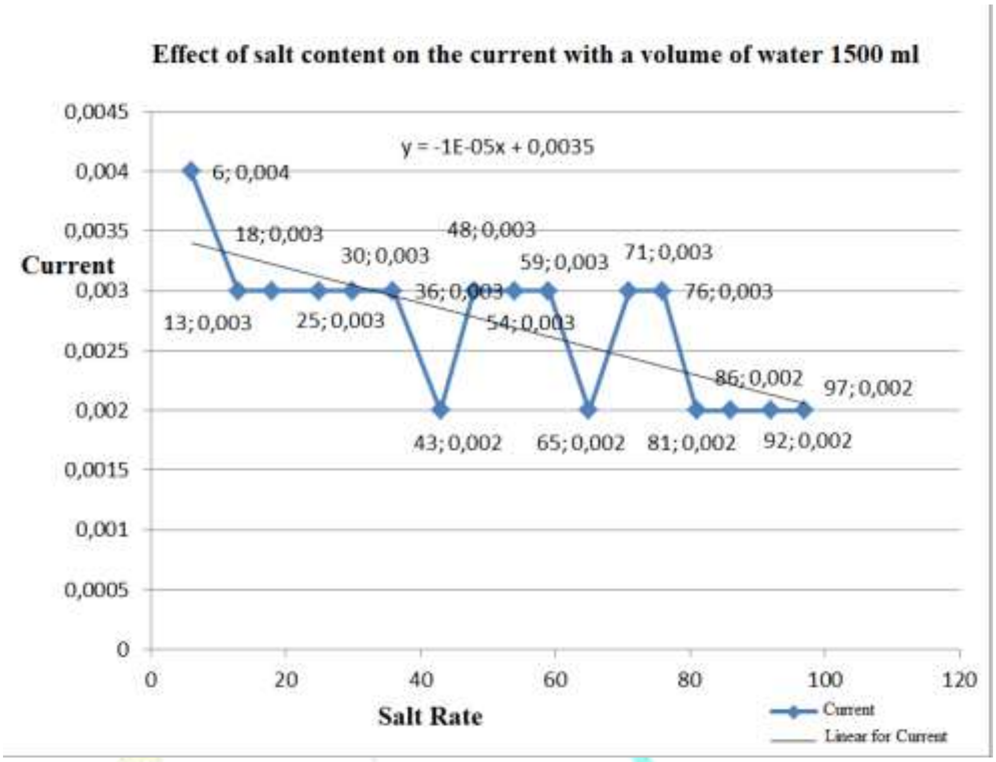


Figure 4.6 effect of salt content on the current with a volume of water 1500 ml

Table 4.4 data of test results with sea water

No	Volume of sea water (mL)	Salinity of sea water (ppm)	Voltage (V)	Current (A)
1.	500	33	2,81	0,002
2.	1000	33	2,68	0,003
3.	1500	33	2,24	0,002

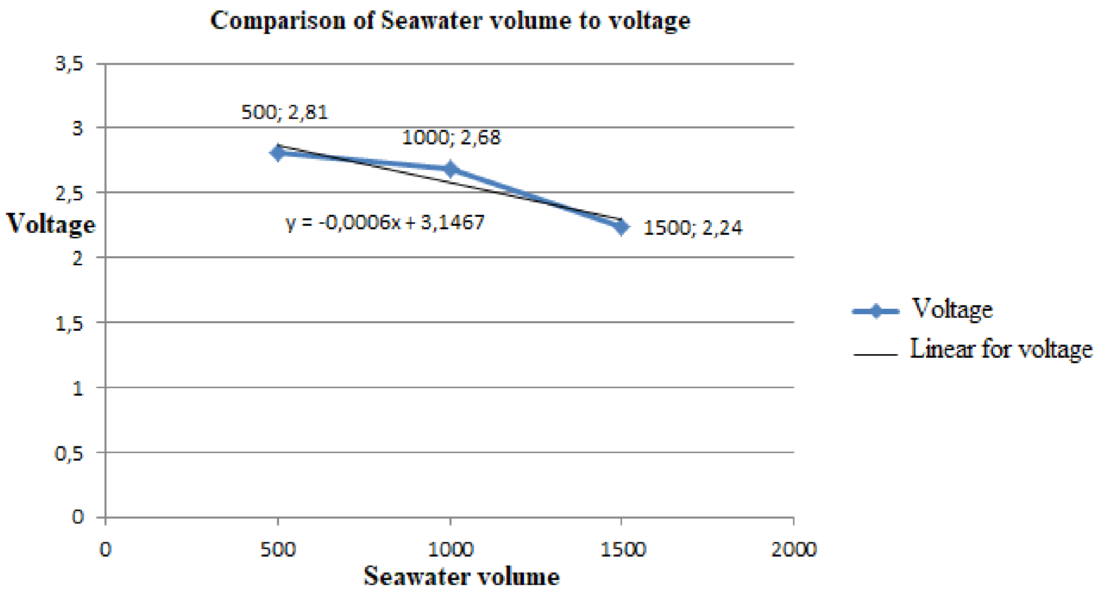
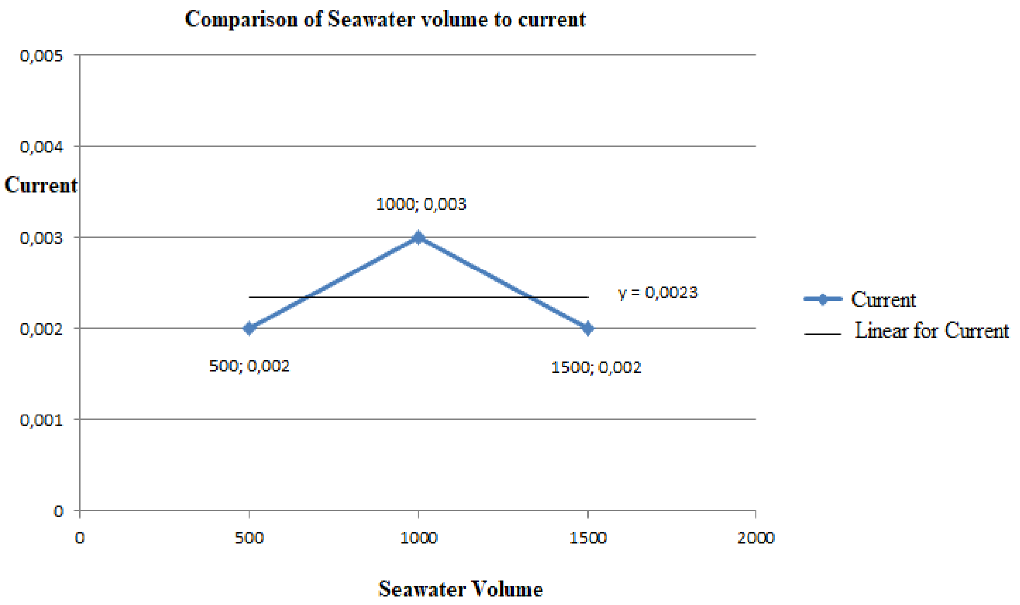


Figure 4.7 comparison of Seawater volume to voltage



Picture 4.8. Comparison of Seawater volume to current

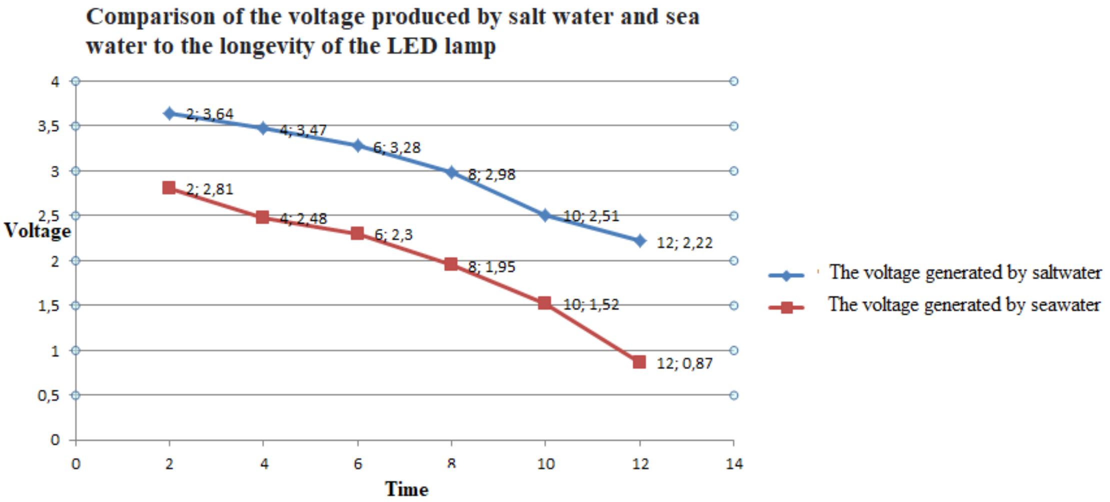


Figure 4.9. Comparison of the voltage produced by salt water and sea water to the longevity of the LED lamp

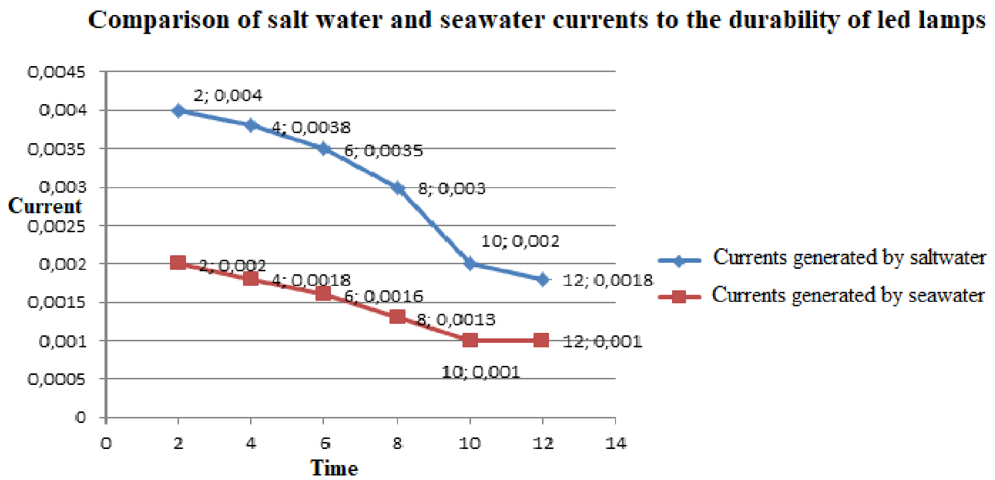


Figure 4.10 Comparison of salt water and seawater currents to the durability of led lamps

From the results of experiments that have been done this can be seen that the salt content is very influential in generating voltage, the comparison between Voltage and current in salt water produced by CV.Tani Makmur and Padang Beach sea water that his second result is clearly different, where the voltage and current produced by salt water with a volume of 1500 ml of salt content denagn 10 gr can produce a voltage of 3.64 V and a current of 0.004 a brtahan able to turn on the led lights for 10 hours, while the voltage and current generated by sea water of 2.81 V and current sebesr 0.002 A is only able to survive turn on the lights for 4 hours only.

V. CONCLUSION

Salt content greatly affects the electrolyte cells in generating voltage and current, where the salt water solution with a volume of water 500 ml , 10 grams of salt mass and salt content of 18 ppm generated voltage 3.46 V and current 0.008 A, at a volume of water 1000 ml, 10 grams of salt mass and salt content of 9 ppm dihasilka voltage 3.16 V and current 0.12 A, at a Volume of water 1500 ml with a mass of salt 10 grams and salt content of 6 ppm generated voltage 3.64 V and current 0.004 A. While in seawater the salt content is the same, namely 33 ppm, with different water volumes also produce different voltages and currents are also produced. Salt solution in the production of CV. Tani Makmur with a salt content of 36 ppm and a water volume of 500ml produces a voltage of 3.22 V and a current of 0.008 A, while the sea water solution of pantai padang with a salt content of 33 pmm and a water volume of 500 ml produces a voltage of 2.81 V and a current of 0.003

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