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LIQUID CHROLINE GENERATOR FROM SEA WATER FOR SWIMMING POOL USING CELL STAINLESS PLATES COATED PLATINUM BASED ON ELECTROLYSIS

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Abstract

This research paper presents the liquid chlorine generator from the sea water for swimming pool using the principle of ion exchange in cell electric based on electrolysis theory. For the data used in the study and experiment with the prototype and use of stainless plates coated platinum electrode. The power supply is direct current (DC) voltage 12 volt 95 ampere 1140 watts to plates as a stimulus reaction and oxidation reduction on electrode terminal each polarity. By the experiment of measuring conductivity, which is a value used in the detection of water with liquid chlorine. To compare both before and after the reaction by measuring the conductivity. And the data from this experiment will be used to create and develop the real machine to be used better in the future.

Keywords: *liquid chroline, electrolysis, swimming pool, high power source, conductivity.*

Introduction

Water is very important in human life as nowadays sea water is used as fresh water. The most commonly used salt separation process is reverse osmosis, which has a high operating cost and most of the equipment is imported from abroad. Therefore, it is possible to convert electricity into fresh water by using electrolysis. Faraday's Electrolysis is the use of Plane Electrode, which supplies direct current to the electrode plate, so that the charge is absorbed into the electrode plate or condensed of electrons through chemical reactions. Another way to use electricity is to use it is to make electrolysis. Electrodialysis is the use of direct current to separate ions from the sea by passing ions through a thin membrane to the opposite electrode. The solution between the electrode concentrations decreased. Membrane plates are used as ion exchange membranes (Ion Permeable Membrane) used in this research.

Therefore in this article, we have introduced the process of electrode position relying on theory Electrolysis is used to precipitate in water. In this research, a prototype was created for the conversion of seawater into liquid chlorine to use to disinfect the pool. The liquid chlorine will not irritate the user of the pool. In this experiment, comparison was made between before and after the reaction. Conductivity measurement and the data will be used to build a real machine that can be used in the future.

Materials and Methods

Electrolysis and charged cells

If the electricity flows straight through any kind of electrolyte there is a chemical reaction, or at least mass transfer occurs in that system. This process is called Electrolysis which is a process that uses electrical energy to change chemistry. A tool used for the process of converting electrical

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energy into chemical change. The tools used for the electrolysis process are called electrolytic cells. Electrolytic cell (in contrast to Galvanic cell which is a cell to produce electricity power from chemical change) the electrolytic cell consists of two suitable conductors, called electrolytes, which are immersed in an electrolyte solution. Both of these types are connected to an external source, such as the battery, as shown in Fig.1. Electrodes connect to the negative side of the battery, called cathode. The other side is called anode. Anode)

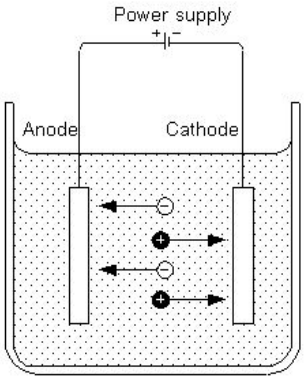

Fig. 1. Electrolytic cell

Conclusion of the mechanism of electrolysis

(1). The mass of the substance formed at the anode or cathode at the time of electrolysis is directly proportional to the amount of electricity entering the cell.

(2). Mass of substances, this happens during electrolysis where the same amount of electricity is directly proportional to the equivalent weight of the substance.

Therefore Electrolysis is very useful in industries such as metal extraction, pure metal electroplating, and the preparation of certain chemicals.

Salinity

Salinity (salinity) is the parameter used to tell the amount of minerals in water from the beginning. This parameter is used to determine the amount of mineral salts in the water by evaporating the water and weighing the crystalline minerals in a way that is inaccurate because of the evaporation of certain minerals incurring a less amount of minerals than actual. The most reliable way to measure the amount of minerals in natural water is chemical analysis. But it is a very time-consuming and often inaccurate method.

Salinity measurements are based on the physical or chemical parameters in water that directly correlate with the amount of mineral in the water. These parameters include: Chlorine content, density, refractive index, and speed of sound, etc. The accuracy of the salinity depends on the accuracy of the physical measurements.

Swimming Pool Disinfection System *[1]*

Swimming Pool Disinfection System Currently used in three systems.

(1). Chlorine system is the most commonly used disinfection system. Chlorine is used in the form of liquids, tablets and chlorine powder by chlorine to kill germs when the water pH is between 7.2 - 7.8. If the pH is too high (very alkaline), it must be added hydrochloric acid (HCl:

Hydrochloric acid) to the water before. If the pH of the water is low (high acidity), it must be added with a buffer such as Buffer or Soda ash (Na_2CO_3: Sodium Carbonate) to adjust pH in water. As chlorine is Irritant to skin therefore, chlorine dissolving should be done in the evening after using the pool. Chlorine adjustments in the swimming pool should be done daily, with chlorine levels at 3 ppm in the summer as chlorine in hot air decomposes rapidly. 2 ppm in rainy and winter seasons

Super chlorine is added to chlorine 2-3 times, usually to adjust the chlorine to 4 ppm, which is done after the date of many people swimming. Or lichen in the pool or to destroy ammonia and contaminants that have accumulated in water. Super chlorine can be done once or twice a week.

(2). Salt system is a system to control the clean water with salt system. By using a salt chlorinator, this system uses natural salt (NaCl: Sodium Chloride) to disinfect chlorine. Electrolysis is produced by sodium hypochlorite (NaOCl: Sodium Hypochlorite) and NaCl. Salt is used when disinfection is not lost. It is only when the Back Wash is cleaned. Or rain until overflowing from the pool. Salt is added 2-3 times a year and salt water is only 0.3% (about half of the tears).

The advantage of this system is that it does not cause skin irritation. The price of salt is cheaper than chlorine. Save on labor costs for maintenance. Do not add salt as often as chlorine easy to use, because it is automated. And it is easy to install. It can be used with existing swimming pool.

The limitation of this system is that the price of the device is high (Salt Chlorinator) water has a brackish taste. Water must be removed if the salt concentration is too high.

The salt used in the first system uses about 3 kg of salt per cubic meter of water. The caretaker will measure the pH of the saline solution and add salt or acid a little as for the water in the pool is PH neutral.

(3). Ozone is a system that removes ozone from the compressed air to treat the water in the pool. It has high performance and can kill germs in a shorter time than other systems and there are no chemicals left in the water. Ozone is a very potent disinfection system when the water through the ozone has been sterilized successfully clean water will go down to the swimming pool.

This system has the disadvantage. While the water in the pool will not kill bacteria until the water comes back through the ozone again. So when there is a human pathogen or from various sources when dive into the pool at an ozone-free time to kill new germs (about 3-6 hours) the infection will remain in the pool will be infected with water in the same pool. Once the water in the pool has returned through the ozone injection machine again the germs will be destroyed. So in some countries there is a law for public pools not allowed to use the ozone system alone. It must be used in conjunction with other systems (e.g., using chlorine or saline) to prevent the spread of pathogens in the pool.

By comparison the three best swimming pools in the world, the best swimming pool in the world is now the salt water system. In Australia, the world's most swimming pools exiting Salt system uses more than 90% of the total pools.

Definition of electrical conductivity of water [2]

The electrical conductivity of water is estimated as the amount of dissolved solids in water or TDS, which stands for all dissolved solids. TDS is measured in ppm (mg / L) or mg / l.

Factors that affect the conductivity of water: The electrical conductivity of the water depends on the temperature of the water: the higher the temperature, the greater the electrical conductivity. Water consumption increased by 2-3%, increased by 1 degree Celsius. Many current EC meter water temperature readings are readily readable to 25°C, while electrical conductivity is a good indicator of overall salinity information on any element of ions in water. The same conductivity can

be measured in low quality water. (Eg, water rich in sodium, boron and fluoride), as well as in high-quality irrigation water. (Eg, adequate water-fertilization with appropriate nutrient concentrations and ratios).

Unit of measurement of electrical conductivity of water

The unit is commonly used for conductivity measurement of water: micro seconds / cm (microsiemens / cm) or dS / m (deciSiemens / m) where: 1,000 microseconds/cm = 1 dS / m

TDS and conductivity EC values

Since electrical conductivity is a measure of the capacity of the water to conduct electricity, it is directly related to the salt concentration dissolved in water and thus dissolves all solids (TDS). Salt dissolves into cationic ions and negative ions which are the conductor. Because it is difficult to measure the TDS in the conductivity field, water is used as a metric. Electric conductivity of water can be determined in a quick and inexpensive way using portable meters. Distilled water does not contain dissolved salts, and as a result it does not carry electricity and has an electric conductivity of zero. But once the salt concentration reaches a certain level, the conductivity is not directly related to the salt concentration. Because this is a pair of ions that occur, the ion pair decreases the charge of each one so that, above this level. The higher TDS will not result in an even higher electrical conductivity.

EC can be converted to TDS using the following calculations.

$$\text{TDS (ppm)} = 0.64 \times \text{EC (micro-seconds / cm)} = 640 \times \text{EC (dS / m)} \quad (1)$$

Electrical conductivity of pure water

Pure water is not a good conductor. Typical distillate water in equilibrium with carbon dioxide in the air is introduced around 10 x 10-6 W-1 * m-1 (20 dS / m) because the electricity is delivered by the ion to solve the increase in conductivity concentration of Ion Rise.

Conductivity of general water :

(1). Purified water • 10-6 S / m

(2). LED Drinking Water 0.005-0.05 S / m

(3). Seawater 5 S / m

Design, construction and operation

Principles of prototype production for liquid chlorine from seawater for swimming pool.

Place the 15 liters of water in a 15-liter reactor. The power supply was then charged at 1140 watts (12 volt 95 amperes) to the open plate for 3 hours. Record the Conductivity every half hour, when the reaction is completed, the power is stopped. Then open the water valve from the reaction tank into the filter. Water will pass through the filter to the tank as shown in Fig.2.

Components of the prototype:

(1) Reaction Tank is the tank used for electrolysis of sea water. (Plate size 15 cm × 6 cm)

(2) A fresh water tank is used to stay out of the central tank to precipitate and reduce the temperature of the water.

(3) Water filter layer consists of coarse sand, fine sand, gravel, glass fiber to filter out sediment from the water.

(4) DC Switching Power Supply: 12 Volt, 95 Ampere, 1140 Watts.

(5) The pump is used to pump water from the tank to the reaction tank

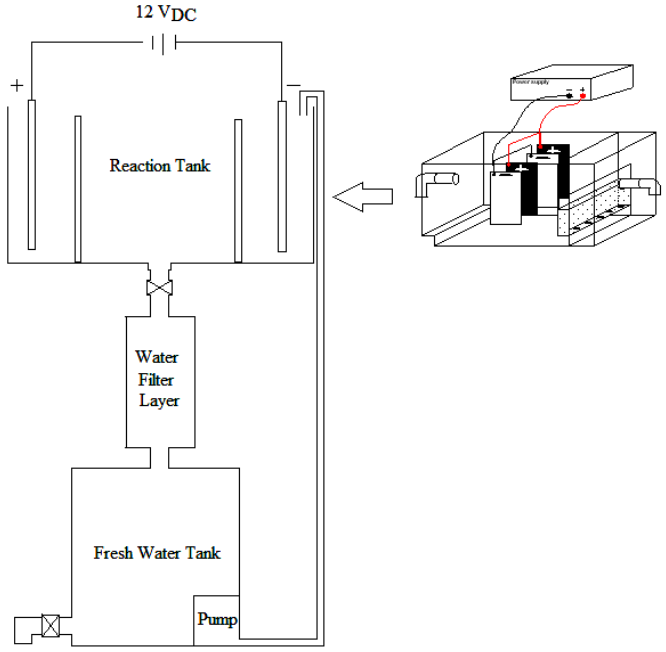

Fig. 2. Liquid chlorine production prototype

Power supply switching power generated

High-power switching power supply is used as a power source for the plate by using a full bridge transistor using transistors. Acting as a switch, the IC#MB3579 is a rectangular signal generator with a frequency of 20 kHz to power the transistor. It will work alternately and also the return of the output sector to maintain the output voltage constant. The high power supply provides about 12 volt output power, 95 ampere load current

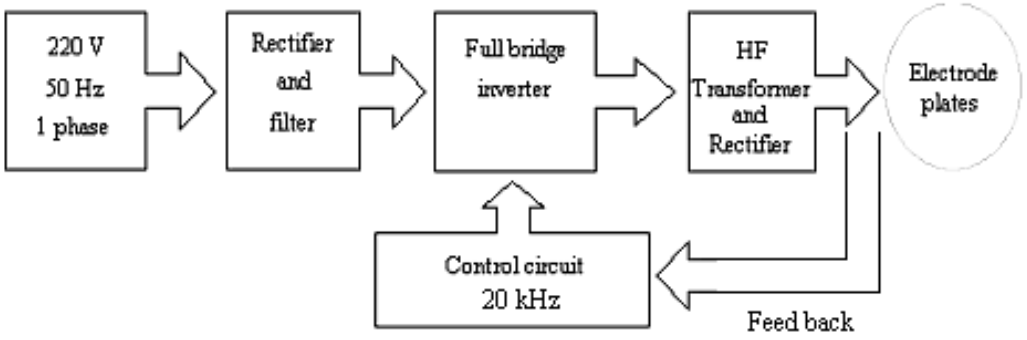

Fig. 3. Block diagram of DC switching power supply

Experimental procedure:

(1) Put the plated stainless steel plate in the reaction tank.

(2) Connect the circuit as shown in fig. 2 by supplying 12 Volt (V_{DC}) 95 ampere to the plate.

(3) Let the sea water flow into the trial. And record the conductivity data in the record table before and after the reaction.

Results and Discussion

Conductivity test for 3 hours and record the electrical conductivity every half an hour before and after the reaction as shown in Tab. 1.

Table 1. Conductivity test for 3 hours and record the conductivity for half an hour before and after the reaction

Time of trial (hours)	Conductivity (μS)
½	938
1	827
1 ½	761
2	674
2 ½	512
3	493

Experimental results of DC switching power supply circuit as shown in Tab. 2.

Table 2. Test results of DC switching power supply. The powers supply the plate in the reaction tank. (Use electrical measuring instrument (Fluke 41))

V_{in} (V)	I_{in} (A)	P_{in} (kW)	cosϕ	V_{out}(V)	I_{out} (A)	P_{out} (kW)	Eff (%)
220	8.95	1.43	0.73	12	95	1.14	79.72

Parameter of Table 2

V_{in} is the input voltage in volt (V), V_{out} is the output voltage in volt (V), I_{in} is the input current in ampere (A), I_{out} is the output current in ampere (A), P_{in} is the input power in kilowatts (kW), P_{out} is the output power in kilowatts (kW), Eff is the efficiency in (%)

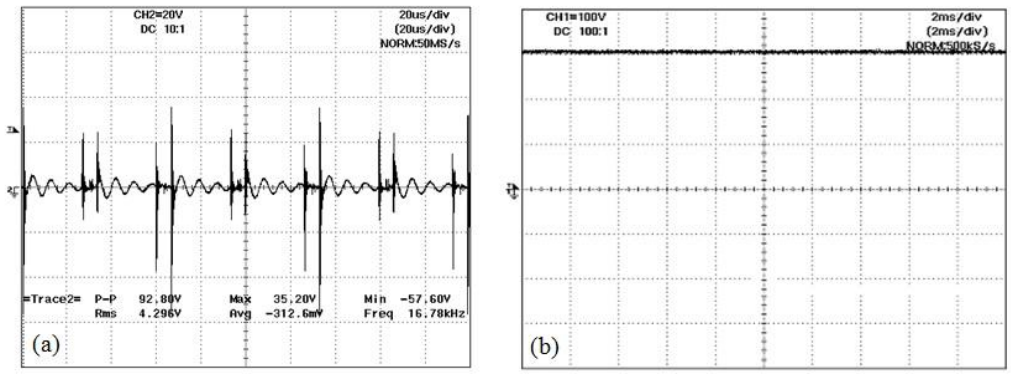

Fig. 4. (a) Power transistor drive signal and (b) 12 V_{DC} output signal (Use DIGITAL OSCILLOSCOPE (YOKOGAWA) to measure the signal)

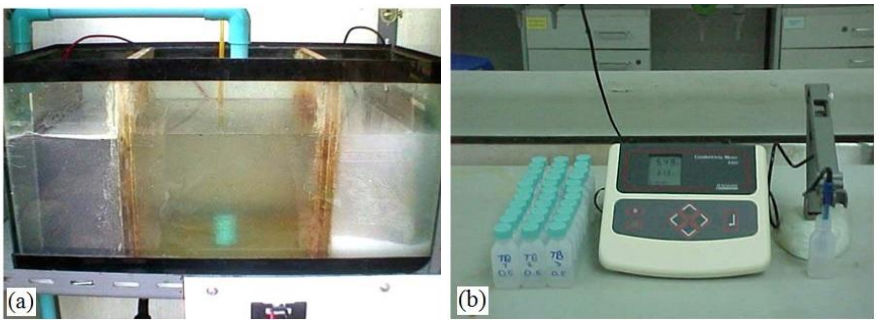

Fig. 5. (a) Front of reactor and (b) Conductivity meter

Conclusion

The experiments showed that the conductivity of sea water. The reaction time is 3 hours and the conductivity is measured every half hour. It can be seen from the reaction of sea water can be converted to liquid chlorine. Liquid chlorine is less concentrated than sea water. As a result, conductivity decrease the salinity was reduced respectively. Table 1 show that sodium chloride dissociates into sodium cation and chloride ions. Liquid chlorine concentrations can also be used to remove germs. The platinum-plated stainless steel sheet is corrosion-resistant to high acidity water. It is appropriate to use.

Future prototype for producing liquid chlorine from sea water for swimming pool with the electrolysis process can be developed to work. It is able tobe an innovation in the commercial.

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