

SALT WATER ENGINE

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Abstract

The project is about the design of a Salt Water Engine Car, which uses salt water as a source of energy. A potential difference is developed across two electrodes, producing an electric current, using a galvanic cell made from Aluminium and Copper (Al - Cu). The voltage can be used to drive the circuit with a MOSFET (P55N06) that acts as an electronic switch to control current flow. The system is powered by a 3.7 V lithium-ion battery, which powers DC gear motors to provide smooth movement. This system is easy to implement, cheap and environmentally friendly, and eliminates the need for traditional fuels. It can be used for teaching and prototypes, and encourages innovative and green vehicle design.

Keywords- Salt Water Engine, Electrolyte Energy Conversion, Aluminium -Copper Galvanic Cell, Sustainable Energy System, MOSFET Switch, Electrolyte Control, DC Motor Drive, Green Propulsion, Hybrid Energy System, Sustainable Engineering.

1. Introduction

Energy is a critical part of modern living, affecting the economy, technology and society. But as our reliance on non-renewable energy, such as fossil fuels, increases, it causes ecological problems, including environmental pollution, global warming, and resource depletion. These problems indicate that we need efficient, clean and sustainable energy sources. The Salt Water Engine is a new concept that illustrates how basic electrochemical principles can be harnessed to produce useful energy in an environmentally friendly manner.

Energy plays a vital role in the industrial, transportation, medical and telecommunications sectors, and consumption is growing. Coal, oil and natural gas cause issues such as greenhouse gas pollution and environmental degradation. Renewable energy systems are needed to address

these concerns. The Salt Water Engine is an easy and innovative model using electrochemistry and

electronics to convert chemical energy to electrical and mechanical energy.

This system uses a salt-water solution (NaCl) and Aluminium and Copper electrodes to generate a voltage. This voltage is used as the gate voltage of a MOSFET (P55N06) that controls the current from a 3.7 V battery to DC gear motors.

This system is switched on by adding salt water and off by drying the salt water, thus the vehicle moves and stops accordingly. This project illustrates an environmentally friendly and self-regulating system, using natural chemical processes to power electronic devices.

2. Related Work

There has been a growing interest in the development of alternative energy systems to

meet the demand for sustainable and environmentally friendly energy sources. Galvanic cells and metal-air batteries, as types of electrochemical energy conversion devices, have been extensively researched for their capacity to directly convert chemical energy into electrical energy in an eco-friendly manner. Pioneering works by Bockris and Reddy [1] and Bard and Faulkner [8] discuss the fundamentals of electrochemical reactions and electrodes, which are essential for understanding such systems. Linden and Reddy [2] also detailed the development of battery technologies, such as primary and secondary electrochemical cells, their advantages and disadvantages.

Winter and Brodd [3] also explained the principles of batteries, fuel cells and supercapacitors with a particular focus on their use in contemporary energy storage and conversion devices. Aluminium-based electrochemical systems have been the focus of recent research efforts as a means of high-energy-density, abundant energy storage.

Wang et al.[4] discussed the progress of aluminium-air batteries for renewable energy storage. These batteries use aluminium as an anode that gets oxidised in the presence of an electrolyte to produce energy. Besides the generation of power through electrochemistry, power electronic devices are also used for control and application of low-voltage systems.

Baliga [5] and Mohan et al. [6] explained the working of semiconductor power devices, such as MOSFETs, that are commonly used for power control as they switch very quickly and consume low power.

Rashid [9] also discussed the use of power electronics in energy conversion systems. There have been many studies on the integration of renewable energy in engineering systems.

Kalogirou [7] discussed the role of renewable energy systems to minimize the environmental burden and achieve sustainable development. But much of the previous work has been on larger systems, with little experimentation on low-cost,

small-scale educational systems. The Salt Water Engine proposed in this project further expands on these ideas by combining an Aluminium-Copper galvanic cell and a MOSFET-based switching circuit to provide automatic control of a DC motor. In contrast to the traditional method, the electrochemistry cell in our project is used to trigger the circuit rather than for power generation, resulting in an efficient start-stop operation. This is a unique integration of electrochemistry and power electronics for sustainable and educational purposes.

3. Materials and Methods

This chapter presents the materials, design, configuration and experimentation followed to develop the Salt Water Engine model. The new system combines the generation of electrical energy through an electrochemical system and the electronic switching to provide controlled propulsion powered by renewable energy sources.

A. System Overview

The Salt Water Engine is designed to be a combined electrochemical-electronic engine converting chemical energy into electrical energy, which is then converted to mechanical energy. The system is made up of an aluminium-copper (Al-cu) galvanic cell, which has salt water as electrolyte. This potential is used to trigger an electronic switching circuit design that uses MOSFETs and then operates DC gear motors, which are operated by a lithium-ion battery.

The overall system consists of three stages:

- Electrochemical energy generation
- Electronic switching and control
- Mechanical propulsion

fig:1- Circuit diagram of Salt Water Engine

B. Electrochemical Cell Design

The electrochemical cell is formed by a galvanic cell of two different metals in an electrolyte. The anode is the aluminium, which is undergoing oxidation, and the cathode is copper. When added, there will be an ionic conduction, which will establish a voltage between the electrodes and salt water. This voltage will depend on the concentration of the electrolyte and the electrode area. This will be enough to drive the MOSFET gate and switch the circuit on.

C. Electronic Switching Circuit

The electronic switch is a MOSFET (P55N06) as it has a high input impedance and low gate drive. The electrochemical cell is connected to the gate of the MOSFET.

If the electrolyte has enough voltage:

- MOSFET becomes conducting.
- Current from the battery flows through DC motors.
- Car starts moving.

As soon as the electrolyte dries, the gate voltage falls, and the MOSFET is turned OFF. The vehicle can be made to start and stop automatically.

Mechanical Propulsion System

The vehicle is fitted with two DC gear motors. This allows for smooth transmission of torque that enables efficient motion at low power. The motors will be used to transform the electrical energy provided by the MOSFET circuit into rotational energy.

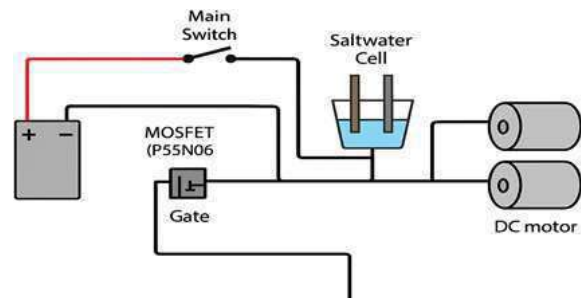
D. Experimental Setup

The experiment will be carried out by immersing aluminium and copper electrodes in a saltwater tank. The electrodes are hooked up to the gate of the MOSFET, and the battery is hooked up to the motors through the drain-source of the MOSFET.

The following procedures were followed:

- 1) Saltwater electrolyte preparation.
- 2) Placing of insulated electrodes.
- 3) Wiring and circuit testing.

- 4) Filling electrolyte to operate the system.



- 5) Start and stop the motor.

E. Working Procedure

The system operates as follows:

- 1) Saltwater electrolyte is used to initiate an electrochemical reaction.
- 2) Voltage is generated by aluminium and copper electrodes.
- 3) MOSFET gate is triggered.
- 4) DC motors run on a battery.
- 5) The car continues to run until the electrolyte dries.
- 6) MOSFET stops, shutting down.

F. Performance Evaluation Method

The system operates as follows:

- 1) Saltwater electrolyte is used to initiate an electrochemical reaction.
- 2) Voltage is generated by aluminium and copper electrodes.
- 3) MOSFET gate is triggered.
- 4) DC motors run with battery.
- 5) The car continues to run until the electrolyte dries.
- 6) MOSFET stops, shutting down.

These parameters confirm the possibility of introducing electrochemical triggering to electronic control to use in sustainable propulsion applications

4. Results and Discussion

A. Experimental Setup Performance

We tested the Salt Water Engine prototype to determine the conversion of chemical energy to electrical and mechanical energy. It was a system that comprised an electrochemical cell with aluminium-copper electro-chemicals in a salt-water electrolyte, a MOSFET switch, and a DC motor. The test was performed at a constant electrolyte concentration

and distance between the electrodes.

The pouring of the salt water into the container triggered an electrochemical reaction between the aluminium anode and copper cathode, producing a voltage. This voltage was applied as a gate voltage to the MOSFET, and the current from the external battery flowed to the DC motor.

B. Voltage and Current Observation

An open-circuit voltage of 0.7 V to 1.1 V was generated in the electrochemical cell, depending on the concentration of the electrolyte and the state of the electrodes. The current generated was not large but enough to trigger the MOSFET. The results of the experiment confirmed that: The more salt concentration, the better the ionic conductivity and the voltage stability.

C. Motor Activation and Automation Behavior

When the theory was neutral (no electrolyte), the DC motor was switched OFF, which means there was no leak current. The motor was switched ON automatically when the electrochemical voltage was created by adding salt water to the MOSFET. The motor was turned off by the reaction, stopping when the electrolyte was added.

It is a good automatic control system without the use of switches and sensors. It is an effective system that operates as a chemical automation system.

D. Energy Conversion Analysis

The proposed system is a multi-step energy conversion system:

- 1) Chemical Energy → Electrical Energy (Electrochemical Cell)
- 2) Electrical Energy → Electronic Switch (MOSFET)
- 3) Electrical Energy → Mechanical Energy (DC Motor)

The electrochemical cell is not directly used to drive the motor, but as a low-power source to control it, which is more efficient in the long term, as there is no need to continuously power the motor.

E. Advantages Observed

The results of the experiment were able to demonstrate the following advantages:

- Eco-friendly operation with saltwater electrolyte.

- Self-switching operation without controllers.
- Cheap and readily available components.
- Educational model for renewable energy.

F. Limitations and Challenges

The limitations were observed though it worked:

- Stability because of the corrosion.
- Voltage as a function of concentration.
- Not suitable for high-power operations without scaling.

The future possibilities might be a non-corrosive electrode, a better electrolyte and energy storage.

G. Discussion

The results obtained prove a successful The experiments show the successful integration of the electrochemical processes in brine that can be used as control signals for electronics. The new design will be easier to design than the traditional sensor-based automation, and will work. The electrochemistry with semiconductor switching is a new interdisciplinary approach to integrate the ideas of renewable energy with electronics.

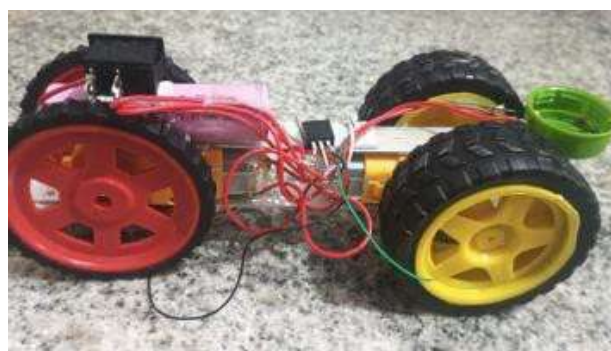


Fig-3: Demo of Salt Water Engine

5. Conclusion

The Salt Water Engine is a simple yet efficient application of electrochemical energy conversion with an Aluminium-Copper galvanic cell, salt-water electrolyte. The chemical reaction produces a low voltage, which is used to switch a MOSFET circuit to drive DC gear

motors, converting chemical energy to electric and mechanical energy.

The device is automatically self-controlled without sensors, as the electrolyte can provide start-stop functions. This demonstrates the possibilities of chemical automation and the combination of electrochemistry with electronic devices for green energy.

The design is inexpensive, easily designed and green, and could be used in an educational setting. While it has drawbacks, such as corrosion and low output power, it proves the concept of "Green Energy Systems"..

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