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Brief Explanation about Greenhouse Cell

Gasser Amr*, Ali Tarek

Department of Environmental Science, Dakahlia STEM School, Dakahlia Governate, Egypt

***Corresponding Author:** Gasser Amr, Department of Environmental Science, Dakahlia STEM School, Dakahlia Governate, Egypt*

E-mail: gaseramr28@gmail.com

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ABSTRACT

A solution has been discovered to address the problem of generating energy from alternative sources of greenhouse gases, taking into account design requirements such as low cost, environmental friendliness, and high efficiency. The experiment involved the utilization of chemical reactions to transfer electrons, thereby generating electrical energy while simultaneously reducing carbon dioxide levels. Carbon dioxide was employed as a catalyst in this experiment, yielding remarkable results. The electrical energy produced was measured using an ammeter, and it was found to be close to 1 volt, thus meeting the desired requirements of the solution. Throughout the experiment, diluted and un-concentrated materials were utilized to assess their effectiveness. This sustainable solution, which aligns with the mission to mitigate the impact of climate change and pollution, can be presented to the world. The energy generated through this method holds significant potential for global implementation, given that energy serves as the backbone of our modern society. By promoting the adoption of this solution, societies can reduce their reliance on traditional energy sources and embrace a more environmentally conscious approach. Furthermore, the utilization of alternative sources of greenhouse gases contributes to the overall reduction of air, soil, and water pollution. In summary, an experiment has been conducted to generate electrical energy from alternative sources of greenhouse gases. The results demonstrate the viability of this approach, offering a sustainable solution that addresses the challenges faced by governments worldwide. The presentation and implementation of this solution on a global scale can pave the way for a cleaner, more energy efficient future.

Keywords: Greenhouse, Carbon dioxide, Environment, Electrical energy, Greenhouse gases

INTRODUCTION

Greenhouse gases are gases that exist in the Earth's atmosphere. They have the ability to absorb infrared radiation from the Earth to space, which contributes to the warming of the Earth's atmosphere. Therefore, they play a role in the phenomenon of greenhouse effect and global warming. Without these gases, the average surface temperature of the Earth would be around -18 degrees Celsius instead of the current average of 15 degrees Celsius. China is currently the largest emitter of harmful greenhouse gases, primarily emitted from coal or oil-fired power plants and vehicle emissions. It has become scientifically established that the accumulation of Carbon Dioxide (CO_2) and Nitrogen Oxides (NO_x), known as greenhouse gases, in the stratospheric layer hinders the penetration of reflected solar radiation from the Earth's surface to outer space. These gases absorb the long-wave solar thermal radiation (infrared radiation), trapping it in the atmosphere, which raises the Earth's temperature [1]. This poses a danger to the climate, environment, and health, and is referred to as the greenhouse effect. After researching these sites and mentioned sources, we have become aware of the danger of this problem to our lives as humans. What will happen if this problem is not addressed, similar to the expansion of the ozone hole, is that it will lead to further global warming and the consequent melting of the polar ice caps. This phenomenon will cause significant problems worldwide and threaten the lives of billions of people. On the other hand, by addressing this problem and harnessing it for energy generation, we can solve many other related issues, such as alternative and environmentally friendly energy sources. There were prior solutions for this problem NASA has developed a new technology that utilizes thin devices powered by solar energy to convert the greenhouse gas Carbon Dioxide (CO_2) into fuel. A solar-powered electrochemical cell is created through the fabrication of thin metal oxide and the combustion of fossil fuel by converting carbon dioxide into fuel using a nano-metal strip [2].

Advantages

- Effective conversion of carbon dioxide.
- High efficiency in utilizing sustainable energy.
- Cost-effective processes.
- Versatile and multifaceted applications.
- Integrated photovoltaic device platform.
- Reduced emissions.
- Production of useful fuel types.
- Utilization of solar energy as the sole energy source.

Disadvantages

- When fuel is burned, carbon dioxide is also produced.

The need for sustainable energy sources and efficient CO_2 management has led to the exploration of novel technologies that can convert CO_2 into useful products. So it has been known that galvanic cells, also known as voltaic cells, offer a promising avenue for this purpose. However, the utilization of CO_2 in galvanic cells is an emerging field that requires further investigation and optimization, for example the copper based electrocatalyst specially nanoparticles of it, has been used to utilize carbon dioxide in galvanic cell by affecting the CO_2 electroreduction the copper catalyst facilitates as the conversion of carbon dioxide into various products. Depending on the reaction conditions and the catalyst's properties, different products can be obtained, such as Carbon Monoxide (CO), Formic Acid (HCOOH), or Methane (CH_4). These products can serve as valuable chemicals or fuels. It's important to note that while copper-based catalysts have shown promise, ongoing research aims to further optimize their performance and selectivity. Scientists are exploring various strategies, such as alloying copper with other metals or introducing nanoscale modifications, to enhance catalytic efficiency and control product selectivity. Therefore, the accuracy of the resulted product from the carbon dioxide isn’t appropriate enough in addition that the resulted chemicals are non-renewable sources that will contribute in increasing the greenhouse gases percentages in the atmosphere. In this research the utilization of carbon dioxide focuses on generating clean energy without any side-effects and uses it at suitable formula in scientific fields such as medical field, so this study aims to answer the following research questions: Can CO_2 electroreduction in galvanic cells be optimized to achieve high conversion efficiency and selectivity for valuable products? Can carbon dioxide batteries demonstrate practical feasibility and offer sustainable energy storage solutions? By answering these questions, we can further our understanding of the potential and limitations of utilizing CO_2 in galvanic cells for clean energy production. Their performance and selectivity.

MATERIALS AND METHODS

After researching previous studies that conducted similar experiments and addressed similar problems, we found it suitable to establish hypotheses and key points to build our initial model based on the previous research. Therefore, we identified several independent and dependent variables.

Independent variable and dependent variable: The dependent variable is the energy produced from carbon dioxide (electricity), which varies proportionally based on the independent variable. We formulated a hypothesis to test the experimental design, which will determine whether the design is successful or not [3]. The hypothesis involves extracting energy from the decomposition of carbon dioxide into its primary components and converting it into electricity and hydrogen, which can be used to produce organic or fossil fuels.

Practical procedures for this design: Production of fossil fuel, elimination of harmful and non-beneficial carbon dioxide through its decomposition, electricity production.

Variables: Independent variable decomposition of carbon dioxide into its primary compounds. Dependent variable energy production from the primary compounds.

Control group: We left carbon dioxide gas without decomposition to observe whether it produces energy or not.

Experimental Group: We decomposed carbon dioxide into its primary compounds to observe whether it produces energy or not. After conducting the experiment, we found that our model succeeded in demonstrating the importance of referring to the experimental group and its impact on the environment. Our model in the experimental group produced 1.5 volts of energy from a minimal amount of carbon dioxide, not exceeding 1 mole. This indicates the efficiency of our initial model. However, in the control group, the model did not produce any energy, indicating the necessity of decomposing carbon dioxide into its compounds to benefit from the energy [4].

Data collection and analysis

The concept of oxidation and reduction is associated with the process of electron transfer. Oxidation involves the loss of electrons, while reduction involves the gain of electrons. The reaction can be divided into two half- reactions: Oxidation half-reaction: Zn → Zn+2 + 2e Reduction half- reaction Cu+2 + 2e → Cu, the oxidation-reduction reaction can be divided into two halves: The reduced half undergoes oxidation, losing electrons, while the oxidized half undergoes reduction, gaining those electrons. The number of electrons gained by the oxidized species is equal to the number of electrons lost by the reduced species (e.g., $KMnO_4$, $K_2Cr_2O_7$, Cu).

Galvanic cell relies on spontaneous oxidation-reduction reactions, serving as a source of electric current. The electrochemical cell consists of two half-cells separated by a semi-permeable membrane or a salt bridge. Each half-cell consists of a metal electrode immersed in an electrolyte containing metal ions with a concentration of 1 M under standard conditions. In this case, the reason why we don't obtain an electric current is that the electrons directly transfer from the oxidizing metal to the copper ions through what is known as a short circuit. To solve this issue, the half-reactions need to be separated using a semi-permeable membrane or by using two different cups, allowing the electrons to flow through a metallic wire. Despite the occurrence of the oxidation-reduction reaction in this setup, we cannot obtain an electric current in this case.

Errors in the experiment are insufficient amount of carbon dioxide was used, There was a leakage from the glass container, which affected the accuracy and there was an error in the equipment, including the voltmeter, which was not accurate enough [5-8].

The necessary materials for the experimental procedure are: Aluminium solution, aluminium electrode, graphite electrode, water, two cups or graduated cylinders, U-shaped tube, carbon dioxide source, potassium chloride, cotton, wires, avometer.

Suggested experience: First, we developed a test plan consisting of several steps to ensure that the experiment is conducted correctly without errors and to achieve the best results. We prioritize cost-effectiveness, environmental friendliness, and safety.

- We select materials that are readily available in Egypt, such as water and graphite, and choose affordable materials of high quality to meet the initial design requirements of our prototype.
- We create a voltaic cell with the same proportions of the materials we are using in our prototype. Then, we observe that the electricity generated by our prototype is higher than that of the voltaic cell. Therefore, our prototype achieves high efficiency with low cost, and the produced gas (H_2CO_3) can be utilized in various industries such as carbonated beverages, pharmaceuticals, cosmetics, and fertilizer production. Thus, our prototype fulfills the second design requirement.
- Our prototype is environmentally friendly as it utilizes carbon dioxide, a greenhouse gas, and converts it into electricity and H_2CO_3. Our prototype does not emit any greenhouse gases and uses environmentally friendly materials such as water. Therefore, our prototype fulfills the third design requirement.

After ensuring the validity of the design requirements, we proceeded to create the initial prototype and tested it. We repeated the testing of the initial prototype multiple times to ensure its long-term effectiveness and the success of the projects expected efficiency. Effectiveness of the prototype: Disposal of carbon dioxide and its conversion into electricity. Production of hydrogen gas, which can be used as a fuel, helping to eliminate harmful gases, and addressing the energy problem (Figure 1).

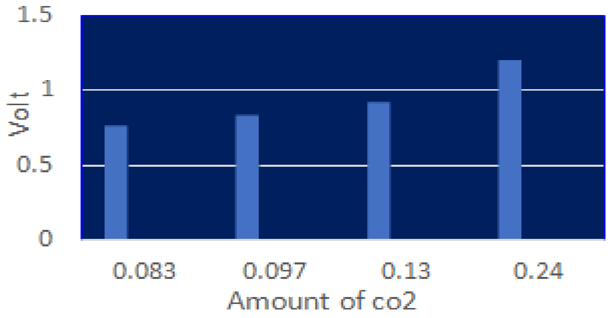

Figure 1: The graph below illustrates the efficiency of our prototype during the experiments.

RESULTS AND DISCUSSION

There is a recorded video in the school under the supervision of the lab teacher demonstrating the experiment to ensure its authenticity. The video has been included in the sources. These are the latest results obtained. It was observed that as the concentration of carbon dioxide increases, the amount of electricity generated by the project also increases (Figure 2).

Amount of co2 with water	0.083 mol of co2 with 2.54 mol of water	0.097 mol of co2 with 2.54 mol of water	0.13 mol of co2 with 2.54 mol of water	0.24 mol of co2 with 2.54 mol of water
No. of output voltage	0.76 ± 0.02 volts	0.83± 0.02 volts	0.92 ± 0.02 volts	1.23 ± 0.02 volt

Figure 2: When the concentration of CO_2 increases, the amount of electricity also increases.

CONCLUSION

After multiple tests were conducted on the prototype, it was determined, based on the results obtained, that the design requirements were successfully achieved. The use of greenhouse gases for energy on a personal scale was significantly improved using renewable resources. In the last test plan, a high voltage of approximately 1 volt was generated, accompanied by a high electric intensity. When compared to previous solutions, it was observed that the prototype is cheaper than a steam engine, considered safer than T.E.G., and more readily accessible than GRGS.

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