

Novel Idea to Reduce Carbon Dioxide from Atmosphere By Galvanic Cell

¹Desai Pinank Niravbhai, ²Desai Tejasvi Niravbhai, ³Desai Nirav Vishnudev
¹⁻²Student, ³Principal
 IIT Madras, H.M.B. Sardar, ITI Bilimora

Abstract - While human race will always keep its carbon footprints on the earth it must continue to find ways out to lessen the impact of fossil fuels consumption. Now in the current era the proportion of CO₂ is increasing day by day and it is very harmful to human beings causing various diseases such as Acidosis, Hypercapnia, asterisks, Alkalosis, Hypoventilation, etc. It currently constitutes about 0.041% by volume of its atmosphere 410 ppm. There is an annual fluctuation of about 3-9 ppm. Which is negatively correlated with the northern hemisphere is growing season if the CO₂ proportion would increase in the environment in this such drastic rate it may create dangerous effect on the earth's atmospheres. We have emphasized to degrees the proportion of carbon dioxide from atmospheres, in return it will produce electricity and some amount of O₂. This is the first attempt to create electricity from CO₂ gas and get oxygen in return. It is not available in any source of internet.

Scenario of Carbon – Dioxide increase in environment every decade

In every decade	Atmospheric CO ₂ (Growth Rate)
2005-2014	2.11 ppm per year
1995-2004	1.87 ppm per year
1985-1994	1.42 ppm per year
1975-1984	1.44 ppm per year
1965-1974	1.06 ppm per year
1959-1964 (6 years only)	0.73 ppm per year

Innovation

Our whole project is inspired by the tree as we know the food process of tree is it inhale carbon dioxide from environment exhale oxygen and in this whole process it generates energy which is known as food. Our battery too works on this idea it inhales carbon dioxide from environment, exhale oxygen and this whole process produce energy known as electricity. We have given the view of galvanic battery to our innovative idea.

Objectives

Rational behind construction of exhibits

To reduce the green – house effect by absorbing CO₂ from atmosphere and produce the electricity and emits the oxygen by the galvanic cell reaction.

Scope

The scope of this battery is much wider. It can be used in generator, battery, as an alternate of lead acid battery, providing electricity, as well as pure air.

Literature Review

Scientific principle –

Galvanic cell

A half-cell consists of solid metal that is submerged in a solution, the solution contains cations of the electrode metal and anions to balance the change of cations.

Here M represents a metal cation an atom that has charge imbalance due to the loss of an electrons

Mⁿ⁺ (oxidized species) + ne⁻ ↔ M (reduced species)

A galvanic cell consists of two half – cells such that electrode of one half is composed of metal A, and electrode of the others half plane is composed of metal B the redox reaction for the two separate half cells are thus.

Aⁿ⁺ + ne⁻ ↔ A

B^{m+} + me⁻ ↔ B

In general, then these two metal can react with each other.

Ma + nB^{m+} ↔ +nB + mAⁿ⁺

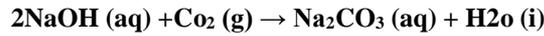
Description: -

Materials: -

Atmospheric carbon dioxide, aluminum coil, activated graphite, sodium Hydroxide (NaOH), Hydrochloric acid (HCL), wire (conducting), Millimeter, Beaker, Salt bridge.

Construction & Working: -

- Two beakers are taken. In first beaker take Sodium Hydroxide and react with carbon dioxide we would get sodium carbonate.



- Aluminum electrode is used as anode and put its sheet in sodium carbonate electrolyte.
- In second beaker take HCL and dipped the graphite as electrode as cathode. Connect aluminum and graphite by wire.
- Connect both the beakers by salt bridge.
- The emf value of H⁺ ion is -0.7 V while n⁺ ion's emf value is 16 V, so it is easy to propagate electricity.
- Now this reduction take place in second beaker,



- Now Cl⁻ ion travels through salt bridge and react with sodium carbonate. So it will replace carbonate ion because of higher emf and make produce salt and carbonate ion.



- Carbonate ion react water and get reduction and produce bicarbonate ion.



- Now on anode oxidation take place. Aluminum is reacting with HCO₃⁻ and get oxidation. It gives aluminum carbonate as byproduct.

Oxidation (on Anode)

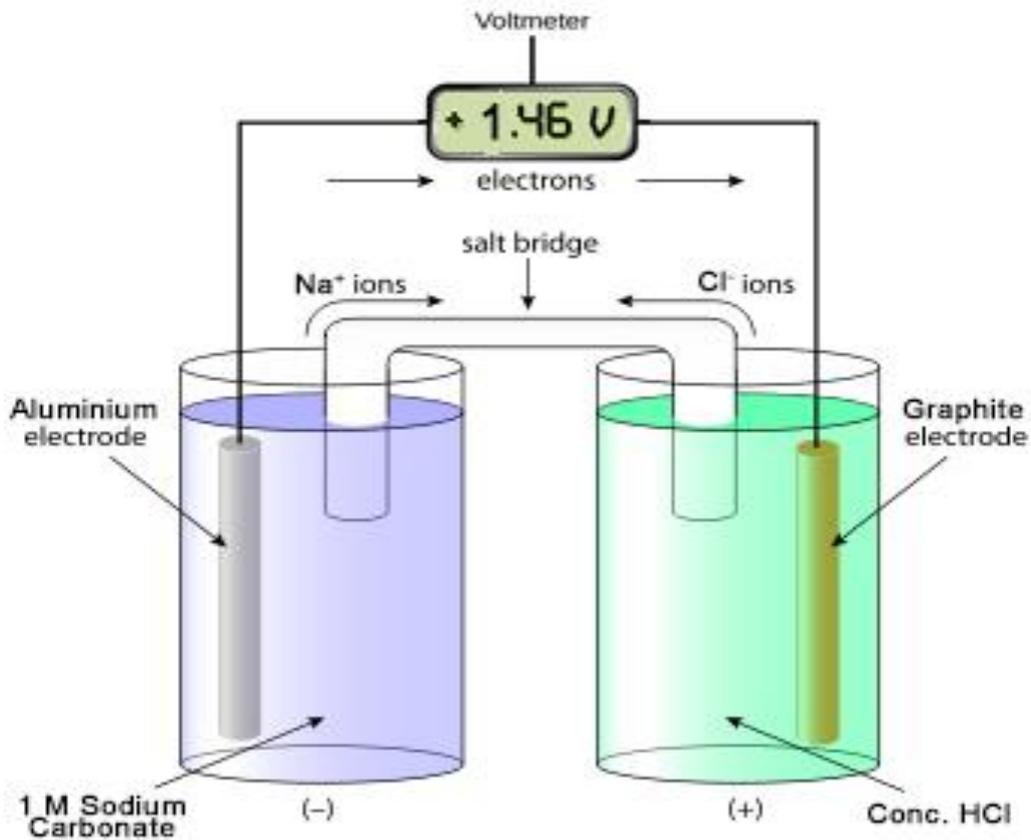


- Now electron travels through wire and helps in reduction of carbon dioxide on cathode. Carbon dioxide is reacted with chlorine ion and oxygen and carbon tetrachloride produces as byproduct

Reduction (on Cathode)

- $\text{CO}_2 + 4\text{Cl}^- + 2\text{H}^+ + 4\text{e}^- \rightarrow \text{CCl}_4 + \text{H}_2\text{O} + \text{O}_2$

Diagram:



Reading: -

When we keep the ordinary battery we are able to get 1.9 to 2.2 volt. While when we connect this three ordinary battery in series we are able to get somewhat 7.2 volt from which we are able to blow a 3 volt led light.

Comparison: -

Lead acid battery	Our battery
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1. Charge = 50 to 95%	It is non-chargeable
2. Cost price = 7 to 18 US \$ (Rs. 420 to Rs. 1020)	Cost price less than t US \$ (Rs. 50)
3. Self-discharge rate = 3 to 20% month	Self-discharge rate – 3 to 20% month
4. Cycle durability < 350 cycles	No cycles
5. Nominal cell voltage = 2.1 volt	Nominal cell voltage 2.2 volt
6. Charge temperature interval -45°C max to -35°C min	Charge temperature internal – Room temperature
7. Specific power = 180 w/kg	Research work is going on
8. Specific energy = 33 + 42 Wh/kg	Specific energy – 6.68 (if life is for 2 days) Research work is going on

Uses: -**1) Mask –**

We can convert our liquid cell into dry cell and can use it into mask which can be used in pollute cities like Delhi for inhaling pure air CO₂ and getting light (electricity) for seeing what is ahead in mist. It can be very useful in city where there is the cloud of pollution arises. Eg. Delhi, Aurangabad.

2) Battery –

We can convert liquid cell into dry cell by electroplating and prepare an ordinary battery which can be household appliances.

3) Car Battery -

we can use this battery in place of lead-acid battery this battery can be used in car and bikes due to which no pollution arise and CO₂ would not mix with air and O₂ would produce which would be exhaust from silencer. so it can be pollution free bike or car.

4) Generator –

We can prepare step down or step up generator from the use of this battery is much good and simpler than generator.

5) Purification of air -

We can prepare the separate plant of this whole battery and can prepare Air purification. Our Air purifies is much ahead than Abu Dhabi 's air purifies because Abu Dhabi's air purifies absorb carbon and release oxygen in atmosphere, but our battery produces electricity as well as pure air.

6) Township-

We have kept our project in a specific location of the city and can provide electricity to street light from our battery. It would purify air and would be helpful in generating electricity.

7) Water purify and Air purify-

By using this battery in hand pump. We can purify water as well as Air and the energy which is produced we can store it.

8) Byproduct-

The byproduct of anode is aluminum carbonate which can be used by dog and cat for digestion in pancreases purpose. While the calcium tetrachloride is formed on cathode it can be used as refrigerant fire extinguisher and as a stamp watermark.

9) H₂ serves as energy-

The vaporize H₂ (dihydrogen gas) which is formed on anode can be used as providing energy to the various sector of infrastructure.

Changes: -

1. It is a need to increase volt of an ordinary battery.
2. Need to make this project implement on large scale.
3. Can use NaCl in place of HCL, because HCL is toxic and Hazardous to use in Public, or for public necessities.
4. Need to prepare in raw form i.e. dry cell, due to which people can easily use it.

Technology Exists: -**1. Carbon capture: -**

This plant is in Switzerland. It is just capturing CO₂ and saturated into various other forms such as methane, ethane, propane, butane, etc. and resale back to the companies which need that factors.

2. Carbon purifier: -

Carbon is purified plant is in Dubai where it bifurcates carbon and oxygen it absorb carbon into graphite and throw oxygen in environment.

3. Air purifier: -

Different type of air purifier is there on earth according to our requirement such as only removing particles, dust or impure air.

Research at school

I firstly given my idea in the website of inspire award 'Manak' scheme while studying in 9th which was approve when I was studying in 10th, I had to prepare a porotype of my project and a working model. For this I was given the scholarship of Rs. 10,000 from government. From all over India total 10,000 students were given scholarship and I was one of them. After that more research work was needed due to which I went to some of the references for the study of galvanic cell, research work done for carbon capture, for conversion of carbon dioxide into various elements.

After that I have done my research work at my school H.M.B. Sardar's chemistry lab with the help of my brother Pinank Desai, over there we start comparing over battery with ordinary batteries and were able to get many amazing results. We were using basic components for research and even various types of household resources. We were using HCl as cathode electrolytic solution but later we used NaCl as acid is Hazardous to be use in public. After several trails at school we were able to get a better result. First we were not able to glow the Led light but after connecting the battery in series we were able to glow Led. The research of this project was done in my H.M.B. Sardar school. Further research in a proper was done in ITI Bilimora's chemistry lab. Over there we were able to get electricity about 2.6 volt which was a great achievement in its own. And even we were able to observe that when we blow air on cathode side and light a match stick the matchstick is not vanishing and it sustains which shows us the presence of oxygen evaporating from it. We would need expert help for more research about the proportion of carbon dioxide, oxygen and by-products are exhaling and inhaling from the atmosphere. We are thinking to commercialized and have an instinct desire to patent the following project. And even we are going to make this project on Mat lab from the help of one of the experts in that field.

Exposure

For my innovative project who's topic is to generate oxygen and electricity by inhaling carbon dioxide from environment, get a very good opportunity and support from government.

Inspire award scheme 'MANAK'

When I was studding in 9th std. I came to know about such scheme of government and I just and placid idea on website of inspire award. After in year when I was studding in 10th std. I came to know on 17 February 2018 that my project is selected and I got scholarship from government to pursue my idea into the reality.

District level

I was studding in 10th so I was not able to give much time to the project due to which my brother Pinank Desai help me a lot to pursue my ideas into reality. On 27 February 2018 in DIET, Surat I presented my idea on district level. I was selected at district level and my project was nominated for state level competition.

State level

The state level competition was on 7 to 9 March 2018, and my board exam was from 12 march 2018, then also my parents supported me too went to Patdi, Surendranagar to present project at state level. My project was selected over their too and now I have to present my project at IIT Delhi for national level.

Workshop at Gandhinagar

A small workshop at Gandhinagar was held on 4 to 6 December 2018, by NIF to improve the project with more reliability. Over there we came to get knowledge about prototype, design, IOT, entrepreneurship and patent/copyrights. From there I was able to know about required changes which should done to make my project more relevant, reliable and effective, even they provide scholarship to make an effective project.

National level

I had presented my project on 14 and 15 February 2019 at IIT Delhi, for National level where I was selected for SAKURA Japan Youth Exchange Program.

'SAKURA' Youth Exchange Program Japan

The government of India selected me for SAKURA Youth Exchange Program and they are going to incur all expenses on me for this trip. This trip is from 20 to 26 April 2019. The Government of India has given me such a big Opportunity and I am very happy for this.

Press Meet

My school provide an opportunity of press and media meet. It was a great exposure for me and I was really glad. Different local newspaper has covered my coverage. Various national and local media came to understand my project.

Car Companies providing support

I have provided information of my project to different car companies and they are excited to see my project and approve it.

Acknowledgment

I want to thank ITI Bilimora for helping me to cary out my project.

Reference

1. The Wikipedia of galvanic cell.
2. The Wikipedia of carbon causing pollution.
3. The novel idea for solves a current problem with own understating & applied knowledge of chemistry