To Investigate The Effect Of Different Types Of Salt On The Speed Of A Saltwater Fuel Cell Car

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Abstract

The main aim of the project is to find out the effect of different types of salt on the speed of a saltwater fuel cell car. We made use of a saltwater fuel cell car and made it run on 4 different types of commonly found salts: less sodium mineral salt, sea salt, coarse salt and Himalayan salt. We calculated the average speed the car took with each salt and concluded that Himalayan salt is the most effective to run the car.

Introduction

The aim of this experiment is to investigate which type of salt allows the saltwater fuel cell car to run the fastest. We chose this experiment as we found the concept of a saltwater fuel cell car very interesting and wanted to experiment if other salts would be more effective. There is a need to do research in this area as alternative fuel has proven itself to be extremely beneficial to the environment and the human race in the long run. The salt water fuel cell is a great form of alternative fuel as it only makes use of various metals and salt water, in which we have an abundance of. Thus, we would like to find out which type of salt would be able to power up the car to move the fastest. The results of the experiment can be extended to future research for real-sized cars in which saltwater is the alternative fuel and it can also be used for powering up other electrical appliances.

Theoretical Background

The saltwater fuel cell car converts chemical energy into electrical energy. In the saltwater fuel cell car, the magnesium acts as the anode, the porous carbon sheet acts as the cathode and the saltwater is the electrolyte. At the anode, the magnesium plate is oxidized and releases electrons. At the cathode, the positive ions, mainly H^+ , from the salt solution gains the electrons and is reduced. The flow of electrons from the anode to the cathode gives rise to the electric current to power and run the car.

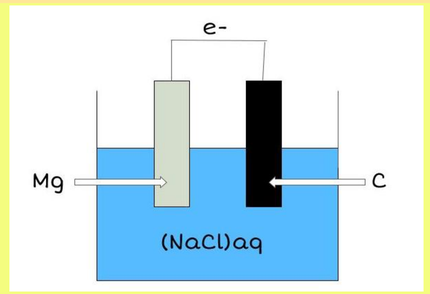
The compositions of the salts are as follows:

Less sodium mineral salt is made up of 56% sodium chloride, 28% potassium chloride, 12% magnesium sulfate, 2% lysine hydrochloride and 0.0036% iodine, with 2% silicon dioxide. It has added mineral nutrients including magnesium, potassium, lysine and iodine that cuts down to about half the sodium chloride, formulated to replace regular salt.

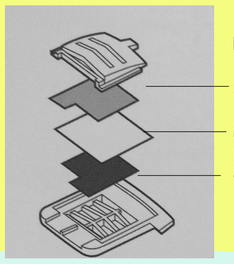
Sea salt is produced through evaporation of ocean water or water from saltwater lakes, normally with little processing. Depending on where the water is found, certain trace minerals and elements are left behind. Elements found in sea salt include sodium, chloride, phosphorus, bromine, boron, zinc, iron, manganese, copper and silicon.

Coarse salt, more commonly known as table salt, contains 97-99% sodium chloride. It also contains iodine.

Himalayan salt consists of 95–98% sodium chloride, 2–4% polyhalite (potassium, calcium, magnesium, sulfur, oxygen, hydrogen), 0.01% fluoride, 0.01% iodine, and micro-amounts of numerous trace minerals.

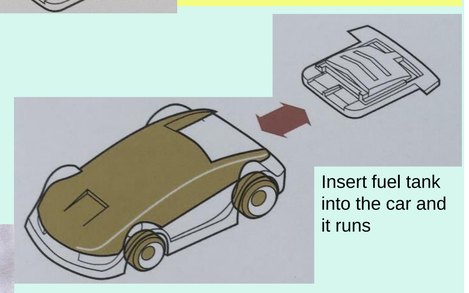


How the salt water fuel cell car works

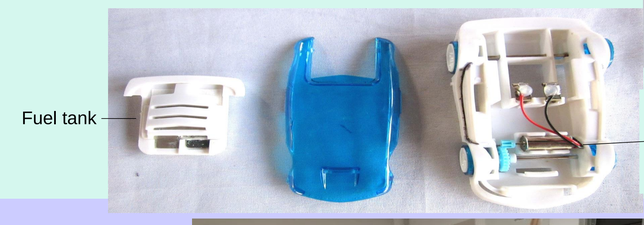


Procedure

1) Insert the magnesium plate and carbon sheet into the car.
2) Prepare a salt solution of 80% water and 20% coarse salt and stir until all salt has been dissolved.
3) Drip 8 drops of the salt solution onto the non-woven fabric which acts as the absorbent material for the electrolyte.
4) Insert the fuel cell into the car body.
5) Place the car on the track immediately and start timing once the car is released.
6) Record the time taken in seconds for the car to run 4 m.
7) Repeat steps 5 to 6 three times with the same salt solution and calculate the average speed.
8) Repeat steps 2 to 7 with the 3 different types of salt solution.
9) Record the 3 timings for each salt solution and calculate the average speed.



Insert fuel tank into the car and it runs



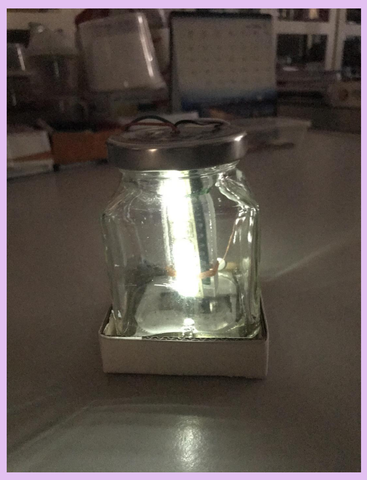
Results

Type of salt	Average speed (m/s)	Ranking
Less sodium mineral salt	0.43	4
Sea salt	0.57	3
Coarse salt	0.60	2
Himalayan salt	0.66	1

Testing the speed of our saltwater fuel cell car

Discussion

From our results, we conclude that Himalayan salt is the most effective salt to use in the saltwater fuel cell car, followed by coarse salt. This is likely because Himalayan salt has the highest amount of polyhalite in it, thus the amount of current produced from it is the highest as it has the highest amount of metal ions in it. However, our group believes that coarse salt should be used as an alternative solution due to the high cost of authentic Himalayan salt. Himalayan salt is the purest and most expensive salt in the world as it is hand-mined and extremely rare. Thus, to use Himalayan salt to fuel real-life cars in the near future would not be feasible. Coarse salt however, is cheap and practical. Since the results we obtained from coarse salt and Himalayan salt did not show a significant difference, we believe that coarse salt is a better choice. We also measured the current and voltage generated by each of the salt solutions. However, it would not produce enough torque to power up real-life cars. As our group wanted to find more ways to apply this concept into our daily lives, we also realized that we could use the current generated from the salt solutions to power up LED lights, which can be used as night lights.



LED night lights powered by saltwater cell

Conclusion

From our findings, our group conclude that coarse salt is the best choice despite Himalayan salt being the most effective. This concept of a saltwater fuel cell car is very good and can be used in the near future as an alternative fuel for real-life cars. Much environmental damage is caused by the frequent use of cars using petrol as fuel, producing carbon dioxide and carbon monoxide in our bustling city life. The salt water fuel cell car uses seawater which is in large abundance and is renewable. Harmful gases like carbon dioxide and carbon monoxide are not produced. However, one disadvantage is the use of magnesium as anode, obtained by electrolysis, which requires lots of energy to extract and magnesium is a finite resource. Pure carbon cathode could also be costly to produce. If more cars in the world use sea water as an alternative fuel, the world will be a better place to live in.

If given the chance, our group would love to investigate how long the saltwater fuel cell car is able to last with the different types of salts.

Reference

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