

DESIGN AND FABRICATION OF SOLAR TREE WITH ARTIFICIAL OXYGEN PRODUCTION

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ABSTRACT

Trees naturally convert the carbon dioxide into oxygen. But today because of Greed Selfish Humans are cutting trees and forests and on that place we humans are building white cement forest. Thus we humans are not getting pure air. Population is increasing and number of trees are decreasing, just like mad society people are cutting trees after trees, even they are cutting hills to build a building to earn money. CO₂ is not good for humans but trees convert CO₂ into oxygen which we humans need to survive. This will lead to Global warming problems, Acid Rain, respiratory disease many more. But do not worry now Artificial Trees will do this Job in future

INTRODUCTION

Trees naturally convert carbon dioxide into oxygen, an element that is necessary for survival of almost all living organisms on Earth. However, in this day and age, humans are cutting down billions of trees for paper, furniture, building supplies, and other purposes. The number of trees is decreasing while the population of humans is growing rapidly. As a result, the oxygen levels are falling while the concentration of carbon dioxide in air is increasing. Air pollution is a major issue for almost all countries across the world. Air pollutants can lead to respiratory illness in humans and animals, create acid rains and deplete the ozone layer. Actions such as carpooling, reducing the use of fossil fuels, and simply turning off a light when leaving a room are ways to reduce harmful carbon dioxide levels in our atmosphere. But the most effective natural sources that eat away carbon dioxide are the trees. Trees take in carbon dioxide and release oxygen during photosynthesis. Therefore, the loss of trees in cities has had devastating results on the composition and purity of the air we breathe. Heavy levels of carbon dioxide gases in cities create thick smog and affect the natural ecosystem. These concentrated levels of carbon dioxide gas create a hostile environment for trees and plants making it difficult for them to grow properly. All these problems necessitate us to design a solution to either overcome them or reduce their effects on human population. And that is the solution that we propose to provide through our model. Our model is capable of generating and releasing pure oxygen in the atmosphere using renewable resources. In addition to it, hydrogen gas is produced which is stored and has potential to be used as fuel later. We believe that such a design will not only aid in supplying pure oxygen to urban environment but also meet lighting demands of developing and developed cities.

WORKING

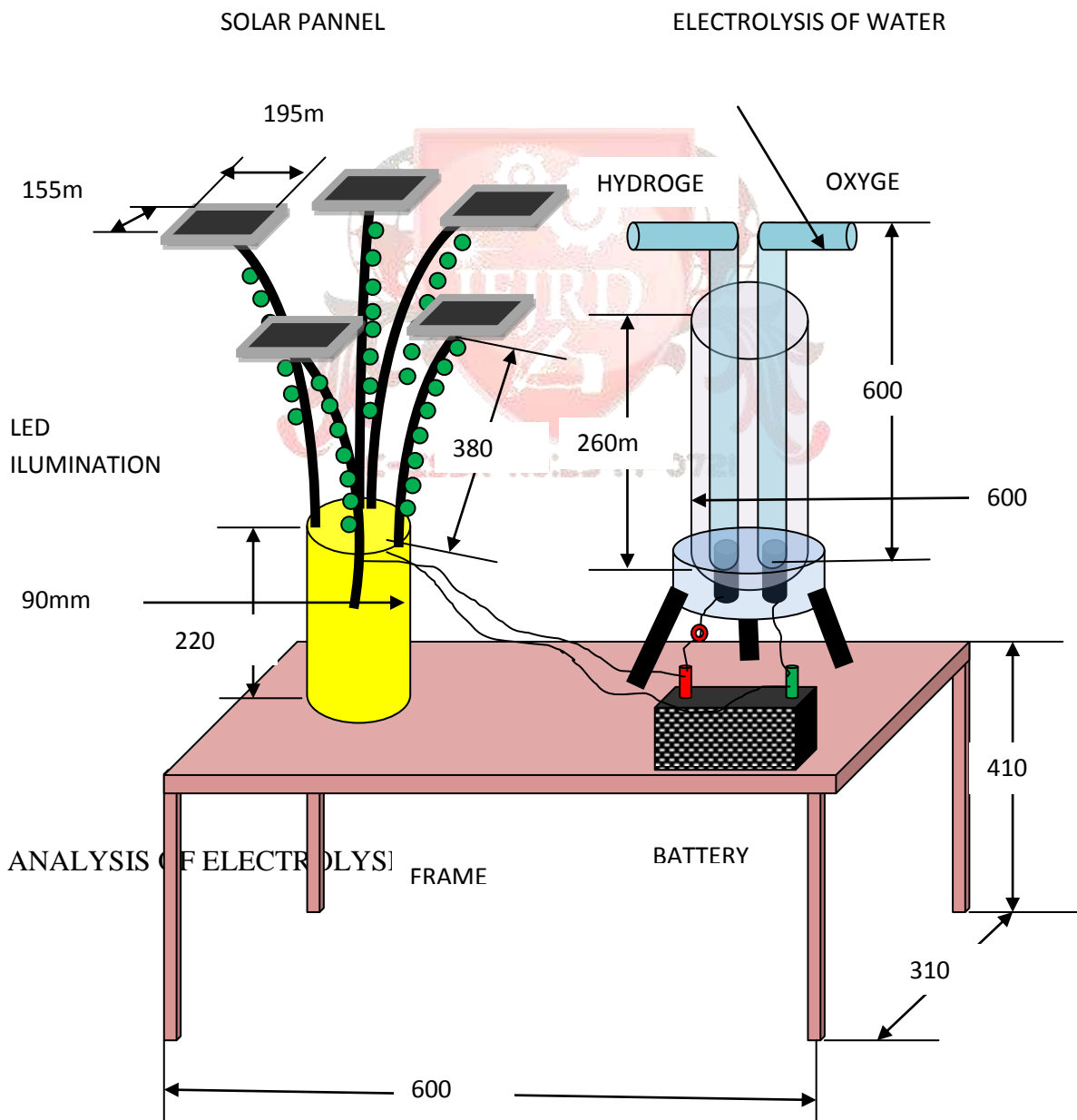
ELECTROLYSIS OF WATER

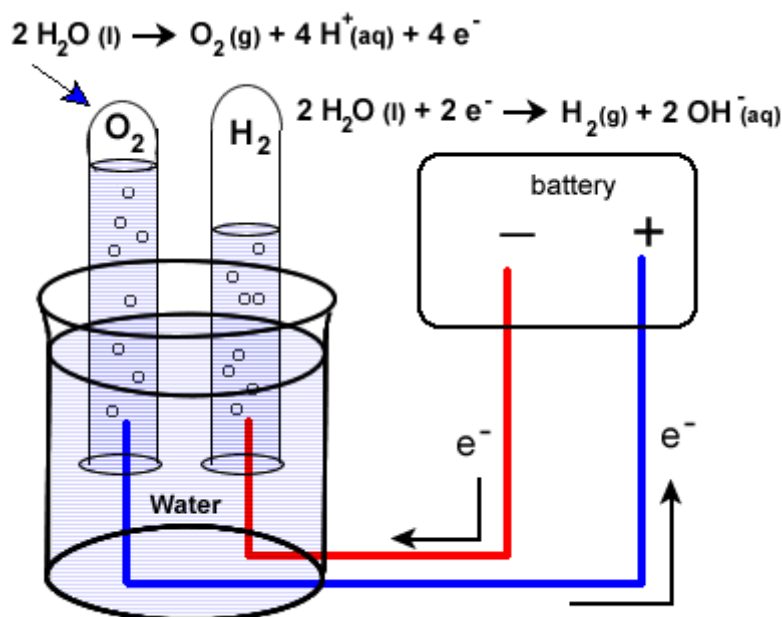
- Electrolysis of water is the decomposition of water (H₂O) into oxygen (O₂) and hydrogen gas (H₂) due to an electric current being passed through the water.
- An electrical power source is connected to two electrodes, or two plates (typically made from some inert metal such as platinum or stainless steel) which are placed in the water. In a properly designed cell, hydrogen will appear at the cathode (the negatively charged electrode, where electrons enter the water), and oxygen will appear at the anode (the positively charged electrode). Assuming ideal faradaic efficiency, the amount of hydrogen generated is twice the number of moles of oxygen, and both are proportional to the

total electrical charge conducted by the solution. However, in many cells competing side reactions dominate, resulting in different products and less than ideal faradaic efficiency.

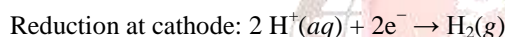
- Electrolysis of *pure* water requires excess energy in the form of overpotential to overcome various activation barriers. Without the excess energy the electrolysis of *pure* water occurs very slowly or not at all. This is in part due to the limited self-ionization of water. Pure water has an electrical conductivity about one millionth that of seawater. Many electrolytic cells may also lack the requisite electrocatalysts. The efficacy of electrolysis is increased through the addition of an electrolyte (such as a salt, an acid or a base) and the use of electrocatalysts.
- Currently the electrolytic process is rarely used in industrial applications since hydrogen can currently be produced more affordably from fossil fuels.

CONSTRUCTION DIAGRAM

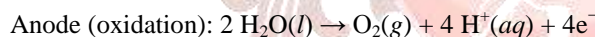




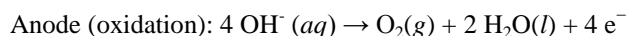
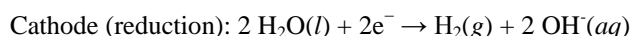
Equation-In the water at the negatively charged cathode, a reduction reaction takes place, with electrons (e^-) from the cathode being given to hydrogen cations to form hydrogen gas (the half reaction balanced with acid):



At the positively charged anode, an oxidation reaction occurs, generating oxygen gas and giving electrons to the anode to complete the circuit:



The same half reactions can also be balanced with base as listed below. Not all half reactions must be balanced with acid or base. Many do like the oxidation or reduction of water listed here. To add half reactions they must both be balanced with either acid or base.



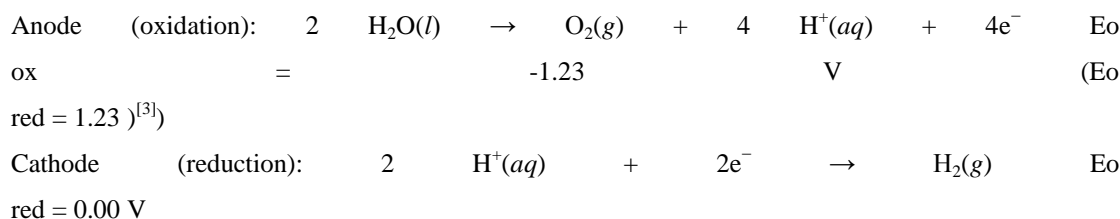
Combining either half reaction pair yields the same overall decomposition of water into oxygen and hydrogen:



The number of hydrogen molecules produced is thus twice the number of oxygen molecules. Assuming equal temperature and pressure for both gases, the produced hydrogen gas has therefore twice the volume of the produced oxygen gas. The number of electrons pushed through the water is twice the number of generated hydrogen molecules and four times the number of generated oxygen molecules.

Thermodynamics of the process

Decomposition of pure water into hydrogen and oxygen at standard temperature and pressure is not favorable in thermodynamical terms.



Thus, the standard potential of the water electrolysis cell is -1.23 V at 25 °C at pH 0 ($\text{H}^+ = 1.0 \text{ M}$). It is also -1.23 V at 25 °C at pH 7 ($\text{H}^+ = 1.0 \times 10^{-7} \text{ M}$) based on the Nernst Equation.

The negative voltage indicates the Gibbs free energy for electrolysis of water is greater than zero for these reactions. This can be found using the $G = -nFE$ equation from chemical kinetics, where n is the moles of electrons and F is the Faraday constant. The reaction cannot occur without adding necessary energy, usually supplied by an external electrical power source.

Pure water is a fairly good insulator since it has a low autoionization, $K_w = 1.0 \times 10^{-14}$ at room temperature and thus pure water conducts current poorly, $0.055 \mu\text{S}\cdot\text{cm}^{-1}$. Unless a very large potential is applied to cause an increase in the autoionization of water the electrolysis of pure water proceeds very slowly limited by the overall conductivity.

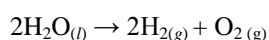
If a water-soluble electrolyte is added, the conductivity of the water rises considerably. The electrolyte disassociates into cations and anions; the anions rush towards the anode and neutralize the buildup of positively charged H^+ there; similarly, the cations rush towards the cathode and neutralize the buildup of negatively charged OH^- there. This allows the continued flow of electricity.^[4]

Care must be taken in choosing an electrolyte, since an anion from the electrolyte is in competition with the hydroxide ions to give up an electron. An electrolyte anion with less standard electrode potential than hydroxide will be oxidized instead of the hydroxide, and no oxygen gas will be produced. A cation with a greater standard electrode potential than a hydrogen ion will be reduced in its stead, and no hydrogen gas will be produced.

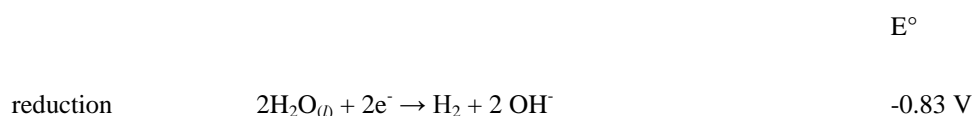
ELECTROLYSIS OF WATER

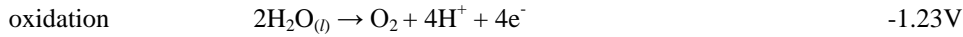
Our second example of electrolysis and electrolytic cells involves the breakdown of water. We will find a situation very similar to the electrolysis of molten NaCl.

The following equation represents the breaking apart of $\text{H}_2\text{O}(l)$:



It may be more difficult to predict the half-reactions involved, but they are:



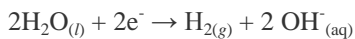


(see note below for net equation)

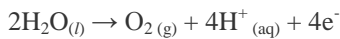
net voltage required - 2.06V

1. Electrons are "produced" in the battery at the anode, the site of oxidation. The electrons leave the electrochemical cell through the external circuit.
2. These negative electrons create a negative electrode in the electrolytic cell which causes the reduction of water.

Note that the area around this electrode will become basic as OH^- ions are produced.



4. Meanwhile the the positive electrode water will undergo oxidation:



5. Electrons produced during this oxidation process will return to the electrochemical cell.

HHO QUANTITY CALCULATION

Calculation

Hydrogen And Oxygen are produced in 500 ml of water.

In 1mol \rightarrow 18ml of H2O molecules
(x) \rightarrow 500ml of H2O molecules

X = 27.7 mols in 500 ml of water.

For Hydrogen,

Mass = number in 1mols \times moles in 500ml of water \times atomic mass of hydrogen

$$\text{Mass} = 2 \times 27.7 \times 1 = 55.4$$

Volume of Hydrogen = Mass/density of hydrogen

$$\text{VH} = 55.4 / 0.899$$

$$\text{VH} = 618.24 \text{ liters of hydrogen gas}$$

For Oxygen,

$$= \text{Numbers in 1 mols Oxygen} \times \text{moles in 500ml of water} \times \text{atomic mass of oxygen}$$

$$= 1 \times 27.7 \times 15.999$$

$$= 442.9$$

Volume of oxygen = mass/density of water

$$\text{VH} = 442.9 / 1.429$$

$$= 309.9 \text{ liter}$$

Battery Hydrogen (12V, 5amp)

Quantity = 1 battery (12V, 5amp)

Ampere hour = Ampere hour positiver number of positive plates

Ampere hour = 5amp × 7 positve

Ampere hour =35 ampere hour

Hydrogen Calculation

= Amere hour × 0.05× 7 cells ×0.016 × cubic feet/amp hr / cell

= 35 × 0.05 × 7 × 0.016

= 0.196 cubic feet / hour

CONCLUSION

Solar Tree draws inspiration from the organic forms of nature, reinterpreting the morphology of the tree and introducing the sensuality of the natural world into the urban context. “This is a project that celebrates design, nature and art and represents the DNA of our time”. A sinuously elegant tree with ecologically intelligent ‘fruits’ – that is, the LED bubbles that light up at night powered by the sunlight accumulated during the day by solar panels. The aesthetic refinement of the design is thus integrated with an extremely high technological content, the result of the innovative research conducted by Artemide in the deep conviction that a concrete solution to the problem of energy saving was needed. An Artificial Oxygen Tree which aims at serving the humanity toward planet, having an ability to perform electrolysis of the sewage water and obtain the Hydrogen (for fuel) and Oxygen (to be emitted in the air) along with generating electricity from solar energy with the help of PV (Photo-voltaic) panels on the top of the trees. Compared to the natural tree, artificial trees are easier to maintain. They further require no regular pruning and can be moved around easily according to the requirements. The trees ‘grow’ well in all climate and does not require water, sun, fertilizer, etc. However, being made of mostly plastic, and not natural materials, is its biggest drawback compared to a natural tree in terms of disposal.

ADVANTAGES

- 1 POLLUTION FREE OXYGEN GENERATION.
- 2 ADDITIONAL POWER IS USE TO GLOW LIGHT IN GARDEN AND PARKING PLACE.
- 3 HYDROGEN IS USE AS FULE IN OTHER APPLICATION

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