WATER AS FUTURE FUEL

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Abstract

Fossil fuel burning vehicles contribute to atmospheric pollution and the continuous temperature increase that affects the entire planet. This occurs because of the accumulation of what are known as Green House Gases (GHGs), which are responsible for trapping the energy of the Sun here on Earth. So, in this project paper, I am going to discuss about how water can be used as future fuel and why fossil fuelshould be replaced. How can water in different forms help to generate energy? I will discuss different forms of ways, from which water can be used as fuel.

- Electrolysis,
- Calcium Carbide, and
- Steam

After this, I will discuss about how lithium batteries affecting environment and life and why should we shift to environment friendly fuel like water? I will discuss adverse effects on resource depletion, global warming, ecological toxicity, and human health impacts.

1. Introduction

The majority of people highly depend on fossil fuels to get through their day. As it is already known, vehicles use gasoline as their fuel, which is strictly derived from petroleum. Although gasoline is a tough competitor in the selections of fuel, mainly because it's fairly easy to produce, as well as use, it has many environmental flaws that are now becoming relevant issues. The problem with using fossil fuels, specifically, petroleum, is that one of the by-products is Carbon Dioxide (CO_2), a Green House Gas (GHG). Now, this is a problem because the increasing levels of this gas are partly responsible for the warming of our Earth, which is often referred to as Global Warming, which is possible through what is known as the Green House Effect. A common misconception of the Green House Effect is that it's completely s to be present in our atmosphere because

- they are responsible for reflecting back the harmful

rays that are emitted from the sun, and
- they keep our planet warm preventing life on it to freeze.

Obviously, the more gas is in the atmosphere, the more heat is trapped; therefore, the gasses in the atmosphere should not be sought to be completely eliminated, rather regulated.
With the use of water (H2O), Hydrogen (H2) has the potential to be an environmentally safe, friendly, and sustainable energy alternative, more specifically, a better fuel alternative for our transportation, which currently relies on petroleum, a non--renewable fossil fuel. One thing to be sure of is that if H2 is going to be used to replace fossil fuels, its manufacturing should also be independent from methods involving fossil fuels. It has always been a farfetched idea –to use water as fuel –but the technology is ready to make this into the fuel of the future.
bad for our planet; the Green House Effect is in fact good to a certain extent.

2. The Power of Water

Water has been thought of being an obvious, yet crazy fuel alternative by using the energy that is locked inside of it. In essence, the splitting of H2O in hopes to directly extract its chemical energy is theoretically impossible due to the fact that it is very stable with strong bonds. Because of this, water must be split and then recombined in order to observe any kind of energy exchange. Furthermore, to successfully achieve the splitting of H2O, a form of:

- electrolysis or
- (mixing with) calcium carbide, or
- by Steam (Methane Reforming)

The use of H2 is the true secret behind using H2O as fuel. Its combustion would have no GHGs, including CO2, and would be safe to manufacture. The only obstacles would be the manufacturing of H2 that is strictly derived from H2O with the use of renewable energy sources and developing a system that would be ideal for a vehicle.

3. Methods

3.1 Electrolysis

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3.1.1 How does it work?

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Anode Reaction:

$$2H_2O \rightarrow O_2 + 4H^+ + 4e^-$$

Cathode Reaction:

$$4H^+ + 4e^- \rightarrow 2H_2$$

3.2 Steam Methane reforming

Natural gas contains methane (CH_4) which will be accustomed produce hydrogen via thermal processes including steam methane reforming and partial oxidation.

Hydrogen is often produced via steam reforming of fuels including gasoline, propane, and ethanol. But about 95% of the hydrogen produced within the U. S. today is formed via steam methane reforming, during which high-temperature steam (700 – 1000°C) is used to produce hydrogen from a methane source like natural gas. The methane reacts with steam under 3-25 bar pressure within the presence of a catalyst to supply hydrogen, carbon monoxide gas, and a comparatively bit of CO2. The carbon monoxide gas and steam are then reacted employing a catalyst to supply CO2 and more hydrogen, this is often called the "water-gas shift reaction." within the final process step, called "pressure-swing adsorption," CO2 and other impurities are removed from the gas stream, leaving essentially pure hydrogen.

Methane:

$CH_4 + H_2O$ (+heat) $\longrightarrow$ $CO + 3H_2$

Propane:

$C_3H_8 + 3H_2O$ (+heat) $\longrightarrow$ $3CO + 7H_2$

Gasoline: (using iso-octane and toluene as example compounds from the hundred or more compounds present in gasoline)

$C_7H_{18} + 8H_2O$ (+heat) $\longrightarrow$ $8CO + 17H_2$

$C_7H_8 + 7H_2O$ (+heat) $\longrightarrow$ $7CO + 11H_2$

Water-gas Shift reaction:

$CO + H_2O \longrightarrow CO_2 + H_2$ (+small amount of heat)

3.3 Calcium Carbide

Calcium carbide, which produces acetylene gas upon reaction with water, could possibly be used as a vehicle fuel. The thought of using acetylene gas within the combustion engine such it reduces the demand of the petroleum products that's getting to be extinct in near future. It includes about the emissions of harmful gases which will be reduced by the utilization of acetylene rather than petroleum products. Various fuels are tested on IC engines for their suitability as alternate fuels. Expect few alcohols, CNG and LPG, not many fuels are found to be matched with IC Engines requirements. Acetylene was evaluated during a single-cylinder engine to research performance and emission characteristics with special emphasis on lean operation for NOX control. Testing was carried out at constant speed, constant airflow and MBT spark timing. Equivalence ratio and compression ratio were the first variables.

The engine operated much leaner when fueled with acetylene than with gasoline. With acetylene, the engine operated at equivalence ratios as lean as 0•53 and 0•43 for compression ratios of 4 and 6, respectively. However, the operating range was very limited. Knock-induced pre-ignition occurred either with compression ratios above 6 or with mixtures richer than 0•69 equivalence ratio.

The chemical reaction is an exothermic reaction produced by calcium carbide reacting with water:

$CaC_2 + 2\ H_2O \rightarrow C_2H_2 + Ca\ (OH)_2$

During the reaction acetylene gas and calcium hydroxide is produced and the reaction produces a significant amount of heat, which is lost if only the gas is used for the engine. Calcium hydroxide is a strong alkaline that has to be treated.

The calcium carbide also has to be produced, from calcium oxide by a high temperature burning process,

$CaO + 3C \rightarrow CaC_2 + CO$

And of course, CaO has to be made from Calcium Carbonate by introducing a significant amount of heat.

$CaCO_3 \rightarrow CaO + CO_2$.

4. Case Study: Water-Fueled car

A water-fueled car is an automobile that hypothetically derives its energy directly from water.

Water is fully oxidized hydrogen. Hydrogen itself is a high-energy, flammable substance, but its useful energy is released when water is formed. Water will not burn. The process of electrolysis can split water into hydrogen and oxygen, but it takes the maximum amount energy to require apart a water molecule as was released when the hydrogen was oxidized to form water. In fact, some energy would be lost in converting water to hydrogen then burning the hydrogen because some waste heat would always be produced within the conversions. Releasing energy from water, in excess or in equal proportion to the energy required to facilitate such production.

4.1 Limitations

Most proposed water-fueled cars consider some kind of electrolysis to separate water into hydrogen and oxygen then recombine them to release energy; however, because the energy required for separating the elements will always be a minimum of as great as the useful energy released, this can't be wont to produce net energy.

5. Pros of Hydrogen over Water

- Hydrogen can help tackle various critical energy challenges. It offers ways to decarbonize a variety of sectors – including intensive and long-haul transport, chemicals, and iron and steel – where it's proving difficult to meaningfully reduce emissions. It also can help improve air quality and strengthen energy security. In addition, it increases flexibility in power systems.
- Hydrogen is flexible in terms of supply and use. It is a free energy carrier which will be produced by many energy sources.
- Hydrogen can enable renewables to supply a good greater contribution. It has the potential to assist with variable output from renewables, like solar photovoltaic (PV). Hydrogen is one among the choices for storing energy from renewables and appears poised to become a lowest-cost option for storing large quantities of electricity over days, weeks or maybe months. Hydrogen and hydrogen-based fuels can transport energy from renewable sources over long distances.

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