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Hydrogen as a New Energy Source for India

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A B S T R A C T

Now a days there is issue of pollution by using Conventional fuels and generating Carbon dioxide and Carbon Monoxide , So technology is trending to change the source of energy to hybrid and non polluted way for daily requirement. It is found that Hydrogen has a high calorific value compare to the other gases but it has issue of high volume storage tank. Therefore scientists are working to store Hydrogen in the metal bars or other ways for cause of easy working. Also Hydrogen is blasting gas at a frequent it is tough to ignite in series of combustion process because it may pre ignite and can make spontaneous blast.

Keywords: CV of Hydrogen gas, Non polluted gases, Pure water contents, Heat loss, Clean source of energy, Electrolysis of water.

Nomenclature

HE	Hydrogen Energy
H_{temp}	Temperature of Hydrogen tank
$Energy_R$	Hydrogen energy release rate. (%)
CL_{rate}	Cooling of Hydrogen
Rech time.	Reach raging time
Eff Eng.	Engine efficiency
Vol_{de}	Voltage decrement
$Engine_{Temp}$	Temperature of Engine .
Cool-Batg	Battery rate of cooling rate

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1. Introduction.

Energy consumption is rising fast around the World due to Earth expanding population and growing industrialisation in economics. At the same time, pressure and changes in the climate conserve fossil fuel reserves is mounting society our energy chain and finding a clean source of fuel for expanding road transport mobility sector in the world. Hydrogen is one of the most important factor to produce renewable energy sauce full stop hydrogen is the perfect fuel it is the most efficient and produces no emissions when used in a fuel cell. It's not toxic reduced from renewable resources and is not a greenhouse gas. It has been noted in numerous studies that hydrogen may be only depend on oil and other conventional fuels.

Hydrogen is used for generating power through fuel cell and also it can be used in internal combustion engine as a fuel. Fuel cells have the advantage of significant efficiency benefits versus the internal combustion engine making it primary device for the conversion of hydrogen into power full stop hydrogen is this implant odourless and colourless gas and atom of hydrogen consists of only one proton and one electron its also the most important element in the universe but hydrogen does not exist really in nature it is always combined with other elements for example water is combination of hydrogen and oxygen H2O and hydrogen is not an energy source but it is only produced from other sources of energy so it is referred to as an energy career that is way to store and transport energy.

Hydrogen is the simplest odourless and coral less case and atom of hydrogen consists of only one proton and one electron. It's also the most important in the universe. Hydrogen is found in many organic compounds like hydrocarbons that make up many of our fuels such as gasoline natural gas biomass methanol and propane full stop hydrogen can be separated from hydrocarbons through the application of heat a process known as re forming. Mostly hydrogen is made this way from natural gas but natural gas is fossil fuel so the carbon dioxide released in the reformation process added to the greenhouse effect. Hydrogen has very high energy for its white but very low energy for its volume so new technology is needed to store and transport the hydrogen. And fuel cell technology is still in early development needing improvements in efficiency and durability also be used to separate water into its components of Oxygen and hydrogen.

This process is known as electrolysis. In future hydrogen economy were hydrogen is produced from a variety of energy sources and stored for letter use or it may be transferred where it is needed and then connoted cleanly into heat and electricity. Energy is used to produce hydrogen from water both the primary and secondary forms of energy become renewable and environmentally compatible resulting with an ideal clean and permanent energy system this is known as solar hydrogen energy system. Hydrogen can be used in any application in which fossil fuels are being used today with exception of cases in which carbon is specifically needed hydrogen can be used as a fuel in furnished Intel combustor engines turbines and jet engines even more efficiently than fossil fuels example coal petroleum and natural gas.

Automobiles bus is train seat submarine aeroplane scandal on hydrogen. Hydrogen can also be converted directly to electricity by fuel cells with a variety of applications in transportation and stationary power generation. Metal hydrate technology offer a variety of applications in refrigeration air conditioning hydrogen storage and purification. Combustion of hydrogen with oxygen results in which has many applications in industrial process and speciality. Moreover hydrogen is an important industrial gas and raw material in numerous industries such as computer metallurgical chemical pharmaceutical fertilizer and food industries.

2 .Method of production of hydrogen gas

Iron is being produced commercially from several different RO materials and different processes. The production method is selected best on quality of hydrogen required per day and availability and cost of raw material of hydrogen required use of my products and energy input per kg of hydrogen produced also energy efficiency of process to after hydrogen first by means of thermo chemical process in this process team reforming or partial oxidation process call in natural gas methanol and biomass are decomposed full stop the carbon monoxide produced in the process is elementary by water gas shifted reaction full stop hydrogen production by this method causes carbon dioxide emission.

Second method, bye electrolysis in this method hydrogen is produced by splitting motor into hydrogen and oxygen by using energy from solar wind geothermal and nuclear through electrical means and third one is water splitting is possible through thermoses means thermal analysis process using energy from solar wind geothermal nuclear etc and fourth water spitting is possible through bio photolysis process using energy from solar radiation and fifth from sunflower oil and sixth from coal gasification.

2.1 Thermo chemical Process

Thermo chemical process can be used to produce hydrogen from biomass and from fossil fuels such as natural Gas and petroleum. Hitting biomass with limited or no oxygen present cause by it to a mixture of hydrogen and carbon monoxide known as synthesis cash or sand gas. Synthesis gas can then be catalytically converted to increase the amount of hydrogen with a water gas shift reaction which reacts the carbon monoxide with water to carbon dioxide and hydrogen. Another high temperature process can convert biomass 2 and only liquid known as paralysis oil and which can be converted to hydrogen using steam reformation and the water gas shift reaction.

Steam reforming of methane is the most energy efficient commercialised thermo chemical hydrogen production technology currently available and most cost effective when applied to large constant lots. In this method is converted to hydrogen by steam reforming carbon monoxide is the by product in this process reaction full stop the research is going on advancing the technology needed to produce hydrogen from fossil fuels and build operator zero emissions..

2.2 Electrolysis of water

This is simplest method of hydrogen production it is preferred when cheap electric power Impala voter is available in high purity hydrogen is desired purity of 99.7 percentage achieved. Currently this method is not for as efficient or cost effective thermo chemical method using fossil fuels or biomass. The hydrogen obtained by electrolysis is 325 times more expensive then the obtained from reform the process. However electrolysis produces very pure hydrogen get sometimes is an pure condition to avoid the poisoning of the anode catalyst also it would allow for more distributed hydrogen generation and open possibilities for use of electricity generated from renewable resources for hydrogen production.

It can be observe that typical electrolyte self consists of two electrons nickel plated and iron road anode and iron plate cathode and acid like potassium hydroxide sodium hydroxide solution in water as electrolyte and diaphragm usually used as used to prevent electronic contact between the electrodes and passage of gas or gas bubbles

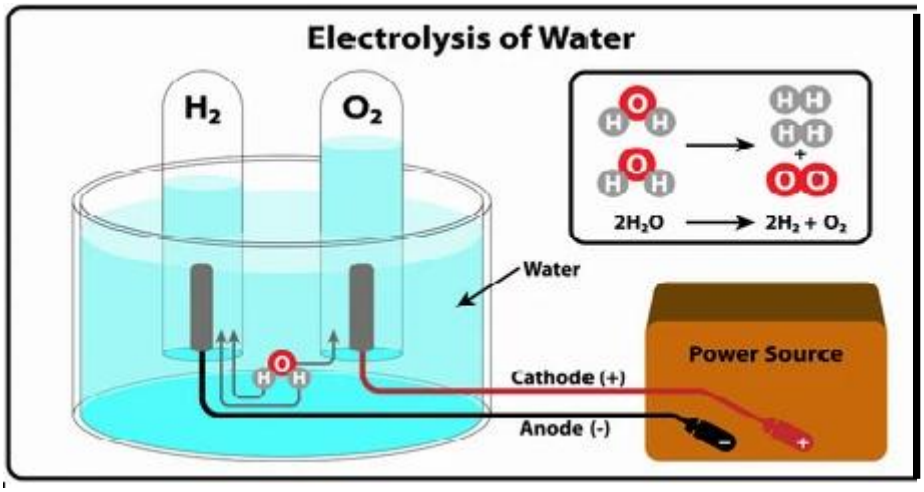

Figure 1 Electrolysis of water

Temperature of sale is maintained around 65 degree Celsius and direct current is passed through electrolyte is direct current decomposes water into H2 and O2 which are released as the cathode and anode respectively. A decomposition voltage of about two world person is applied impact is and electrical energy required is 4.6 kilowatt hour per metre cube hydrogen produced and obviously advantage of this method is the original electricity used for electrolysis is high quality energy percentage energy is utilized for electrolysis.

Therefore efficiency of electrolysis process is about maximum 80% and electrolysis method is most suitable when primary energy is available as electrical energy like solar photovoltaic energy it is also suitable cheap electricity is available from other sources such as wind geothermal extra from an economical point of view when energy is one of the most competitive all the renewable energy for what it could be the cheapest procedure to obtain hydrogen.

2.3 Bio photolysis of water

Another way to directly tab solar energy for hydrogen production is to take advantage of in which nature does show certain micro and photosynthesis bacteria do sometimes use photosynthesis to make hydrogen instead of sugar and oxygen full stop in this method the ability of the allied to split water during photosynthesis process is utilised and artificial system is made which could produce hydrogen and oxygen from water in presence of sunlight using isolated photosynthesis membrane and other catalyst full stop this composition of water using photons in presence of biological catalyst the reaction is called photolysis of water.

System consists of 93 distinct functional components :

1. Photosynthetic membrane comma chloroplast is a small body containing the chlorophyll is green plants is used as a photosynthetic membrane and absorbs light and speed water to generate oxygen electron and proton.
2. Electron mediator, it is reducable by photo synthetically generated electrons and is used as an electron mediator.
3 proton activator, finally dispersed platinum is used as proton activator and accepts electrons from the reduced mediator and cattle is from the reaction.

2.4 Hydrogen production from sunflower oil

In this method hydrogen produce from sunflower oil and water vapour along with two hills specialised nickel best and carbon based catalyst. This process does not in burning of fossil fuel as the hydrogen fuel becomes in renewable. During this process first nickel best unit catalyst absorb oxygen from the air and this interaction hits up the reactor made of the system.

Simultaneously in the presence of heat carbon based absorbent catalyst religious carbon dioxide previously trapped in the device and once a reactor bed is hot and all the carbon dioxide has been released from the reactor the mixture of pauperised oil and water is spread into the reactor chamber full stop hit from the reactor bed breaks down the carbon hydrogen bonds in the vaporised oil and steam its oxygen to the carbon releasing its hydrogen and carbon monoxide there for water vapour and carbon monoxide 10 to form carbon dioxide and hydrogen in the presence of each other this over all process results in cyclic production of hydrogen.

3. Storage of Hydrogen

Hydrogen great acid as a renewable energy career is that it is terrible and transport table hydrogen can be stored as a discrete gas or liquid or in chemical compound. For given amount of energy density of hydrogen is about one third of personal fuel and in liquid form it occupies 3.8 times the volume occupied by gasoline and in gaseous form it occupies 3.6 times that of required by natural gas. Hands hydrogen requires very large storage volume that are impractical for vehicles and many other uses a major drawback of hydrogen is that difficult to transport and store there are 7 possible mode of storage of hydrogen as follows

3.1 .Gaseous state hydrogen storage

Large amount of hydrogen gas for subsequent distribution would probably be stored in the underground facilities similar those used for natural gas. Gaseous hydrogen is most economical and practical hydrogen storage technology and it is non that for given amount of energy density of hydrogen is about one third of fossil fuel therefore in liquid form 8 times the volume occupied by gasoline and in gaseous times that of required by natural gas for hydrogen requires very large storage volume that impractical for vehicles and many other use. Very high pressure of compressed hydrogen could be dangerous in the event of collision therefore current practice is to compress the gas unpressurized tanks but this still provides only limited driving range for vehicles and bulky urgent desirable for other uses also.

3.2. Liquid state Hydrogen storage

Liquid storage of hydrogen is economically visible for stationery and mobile applications and liquid hydrogen fuel is used as a rocket propellant in space vehicles as it has highest energy density more than three times of conventional fuel but to store liquid hydrogen it is required to maintain temperature lower than minus 253 degree Celsius at atmospheric pressure full stop there for it is necessary to use expensive vacuum insulated times that temperature to avoid air condensation over it surface. Also the liquefaction of hydrogen gas required 30% of it energy to attend cryogenic storage for space programs.

3.3. Solid state storage metal hydride

One possible way to store hydrogen at hide density is in the spaces within the solid crystal and structure of metal hydrides and heat then release the hydrogen for use and original metal or allow is recovered for further recycling. Sloan storage in form of metallic hydrides is most attractive method of storing hydrogen and metal hydrides of for the advantage of lower cost of metal hybrid and hydride absorb large amount of hydrogen per unit volume per unit mass. Metal hydride stable with hydrogen gas at atmospheric temperature lower pressure storage very self comfortable chef and reasonable volume metric store efficiency but have white penalties and thermal issues and their for high cost. A metal hydride storage system that could hold 5 kg of hydrogen including the alloy container and heat exchanges would wait approximately 300 kg which would lower fuel efficiency of the vehicle. English technical hydrogen gas is react with powered metallic alloy in closed evacuated pressure is hydride formation is a complete by a negative enthalpy change the access heat of formation is removed during charging.

4. Transportation of hydrogen and its compatibility

Hydrogen entreats as a gaseous substance under ordinary temperature and pressure conditions and at a present it is also produced as a gaseous substance by various hydrogen production methods. The major tropic of hydrogen as a fuel is a difficult in the handling as a gas. Hydrogen is difficult to transport and stock because were reload and city and hydrogen contents large volume last volume and it becomes very bulky for transportations till hydrogen is used where it is produced therefore hydrogen transportation method includes as follows:
First transport by pipeline method generally used for transporting gaseous substance second base transportation method using containers 3rd metal hydrate transportation.

In pipeline generally used transporting yes yes hydrogen for high demand areas in an industrial areas the major operating cost of hydrogen pipe plants is compressor power and maintenance therefore compressors in the pipeline keep the gas moving using hydrogen energy to push the gas forward their for 1000 km 8% of the hydrogen has been used to move it through the pipeline therefore cost of hydrogen transportation is very high compared to the transportation of natural gas.

In case of bet transportation gaseous or liquid hydrogen is transport to consumers in the special design container suggest tank cylinder except that are loaded on trucks and rail cars therefore range about 300 km hydrogen is being transported by high pressure cylinder for every long distance is in the range of 1500 km hydrogen is usually transported as liquid in super insulated cryogenic tankers on road. Trucks and carry in a fuel of 60 cars destructs white 40000 kg but deliver only 400 kg of hydrogen for a delivery distance of 250 km the delivery energy used is nearly about 20% of the usable energy there for hydrogen can also be transported as a solid metal hydride however it is very bulky and concentrations of economical transportation since the weight of metal in its very high and compared to the hydrogen content in the metal hydride.

5. Limitation of hydrogen as a fuel

Hydrogen economy fresher's many technical challenges and high start up cost mainly focused on infrastructure and storage. 2 hydrogen vehicles practical hydrogen fuelling stations must be constructed and strategically located along roadways and in urban centres. The cost of the fuels tax used in hydrogen production and consumption remains two high to be economically competitive with fossil fuel engines. This high cost is due to the precious metals required for reaction catalyst. Hydrogen fuel also remains to expensive and much of the current cost of hydrogen is associated with the transportation and storage and its however developing suffer and more efficient methods to store hydrogen using metal hydrides compressed storage liquid storage and carbon mono structure storage.

In order to economically competitive the cost of fuel cells must below red by a factor of at least 10 and the cost of producing hydrogen must be lower by a factor of at least 4. Even one of the best company must the has developed vehicle agents which is running on hydrogen the advantage of using ice internal combustion engine like vehicle and piston engines is the cost of retailing for production is much lower. Existing technology of internal combustion Indian cons till be applied for solving problems were fuel cells are not viable solution in so far for example in cold weather applications.

On completion of charging cycle to cylinder is maintained at room temperature using cylinder pressure at maximum equilibrium vapour presence of the hybrid when hydrogen gas is required the cylinder is heated to a suitable temperature corresponding to the discharge pressure in order to maintain the required gas flow rate.

Hydrogen has also some limitations concern with fuelling systems and it has higher volume to occupy. So whenever Hydrogen plant is installed it required higher space compare to CNG stations. HCNG is a hydrogen-enriched compressed natural gas (CNG).Compressed natural gas (CNG) vehicles operate much like gasoline-powered vehicles with spark-ignited internal combustion engines. The engine functions the same way as a gasoline engine. Natural gas is stored in a fuel tank, or cylinder, typically at the back of the vehicle. The CNG fuel system transfers high-pressure gas from the fuel tank through the fuel lines, where a pressure regulator reduces the pressure to a level compatible with the engine fuel injection system. Finally, the fuel is introduced into the intake manifold or combustion chamber, where it is mixed with air and then compressed and ignited by a spark plug.

6.Application of Hydrogen fuel

Hydrogen gas is of fuel which is not used in large scale very often because the technique necessary to generate energy out of hydrogen is very expensive and hydrogen is used at space travel here the economy is not much important. Some of countries having started running test with hydrogen gas in vehicles the sum of applications of hydrogen fuel are listed as follows :

Hydrogen is used to fuel spacecraft but also to power life support systems and computers printable water as by product at the present time hydrogen mind use as a space shuttle and other rocket since 97 teams. Hydrogen electrical systems producing pure water which was used by crew as drinking water. The first white spread use of hydrogen will probably BSN attitude to transportation fuels and hydrogen can be combined with compressed natural gas to increase performance and reduce pollution. Adding 20% hydrogen to compressed natural gas can reduce nitrogen oxide emission by 50 percentage in today's engine. Engine converted to burn your hydrogen produces only water and minor amount of nitrogen oxides as exhaust. Special used hydrogen fuel cells to run its computer systems and fuel cells basically rewards electrolysis hydrogen an oxygen are combine to produce electricity.

Hydrogen fuel cells are very efficient and produce only water as by product but they are expensive to build. Hydrogen is used as fuel to power fuel cell generators get create electricity through an electrochemical process in combination with oxygen and technology small fuel cells could someday power electric vehicles and larger fuel cells could provide electricity in remote areas full stop because of the cost hydrogen will not produce electricity on avoid scale in near future it may be added to natural gas to reduce Oxides from existing power plants. Hindi future hydrogen will join electricity as an important

energy career since it can be made safely from renewable energy sources and is virtually non polluting full stop it will also be used as a fuel for zero emission vehicles to heat homes and offices to produce electricity and to fuel aircraft today cost is the major issue.

HD production of electricity from renewable increases so it will be need for energy storage and transportation. Many of this sources especially solar and wind are located are from population centres and produce electricity only part of the time. Hydrogen may be perfect career for this allergy and it can stop the energy and distribute it to what ever it is needed. Hydrogen is used for petroleum recovery and refining to announce performance of petroleum products by removing organic sulphur from today as well as to convert heavy crude to lighter easier to refine and more market table products and hydrogen is used in reformulated gas products helps refineries meet clean at requirements.

7.Conclusion

International level companies like German aerospace centre going and long aviations had tried to use hydrogen fuel cells and aircraft aviation industries but the found that hydrogen angles have jerky issue and they are providing frequent power therefore they can use hydrogen fuel cells as subsidiary or auxiliary unit just like a backup unit. For better uses of hydrogen it is very necessary to store hydrogen in a reliable storage tank and also volumetric efficiency of hydrogen is less so one have to build up large amount of fuel stations that can provide large amount of hydrogen. Also production of hydrogen is increased then oral cost of the fuel will be decreased because hydrogen is a green energy source and it can be mixed with the CNG to reduce the amount of nitrogen oxides in the atmosphere. There for level of pollutions in the atmosphere can reduced by decreasing the total amount of exhaust gas like carbon dioxide carbon monoxide nitrogen oxides sulphur oxides and various unwanted gases. Thus hydrogen can play a vital role in a new era of decreasing pollution level fight for the human kind Safer side. Also hydrogen have higher calorific value therefore it is very useful fuel in the aerospace industries and space applications.

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