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A Novel Approach for Extraction of Hydrogen Gas From Human Urine Through Electrolysis Assisted by Solar Powered Batteries

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Abstract: In the search for novice power generation techniques and methods Hydrogen caught the eye of researchers. Hydrogen has been claimed to be a good alternative to replace fossil fuel since the 1970s. But hydrogen's potential has not been realized even partially mainly because of storage and commercial production difficulties.This paper deals with extraction of Hydrogen from Human urine, reason for choosing human urine, method's to separate urine and flush water, Electrolysis process of urine assisted by solar energy to obtain gaseous Hydrogen, Filtering to obtain pure Hydrogen, further usage of stored Hydrogen to generate power.

I) Introduction:

In the contemporary world Power is the backbone of a Nation and it is the word that is defining the Nation(s) in many aspects, especially their financial growth and Industrial growth. In order to strive and meet up the needs of modern day industrial and domestic needs of its people almost all the nation(s) are in search of novice method for power generation as the traditional or conventional form resources are being depleted at an unimaginably faster rate. Though researchers have done extensive works on Non-Conventional resources like Solar, Wind, Tidal and other renewable resources of energies to generate power but they are having notable drawbacks like unstable frequency of power generation, geographical difficulties etc.. Recently, breakthrough research has been successful in creating a new method for storing hydrogen. But hydrogen does not exist freely in nature, it is only produced from other sources of energy, so it is often referred to as an energy carrier, that is, an efficient way to store and transport energy. This paper deals with extraction of Hydrogen from Human urine, reason for choosing human urine, method's to separate urine and flush water, Electrolysis process of urine assisted by solar energy to obtain gaseous Hydrogen, Filtering to obtain pure Hydrogen, further usage of stored Hydrogen to generate power.

II) Reason for Choosing Urine:

Human urine is one of the most abundantwaste fluid available on earth, its chemical formula is CON_2H_4, though urea is the main constituent of urine its chemical formulareveals the presence of Four (4) Hydrogen atomsper molecule of urine. More importantly these four atoms are pretty loosely bonded than the Hydrogen atoms in the water (H_2O) molecules. This makes us to choose Human urine as prime source to obtain Hydrogen. The Table.1 shows the chemical elements present in the urine.

Table.1

Element	Quantity
Oxygen (O)	8.25 g/l
Nitrogen (N)	8.12 g/l
Carbon (C)	6.87 g/l
Hydrogen (H)	1.51 g/l

III) Separation of Urine from Flush Water:

Both the flush water and urine have to be separated before the electrolysis, to avoid dilution of urine. More over if Flush Water gets mixed with urine, more electricity is need to perform electrolysis as Hydrogen atoms' are strongly bonded with the water molecules. Though both these are different fluids because of their similar densities traditional Decantation method cannot be used. Therefore we have to separate both the Flush Water and urine at the time of urinating only and this requires a special designed urinal commode. The figure.1 shows the redesigned urinal commode that separates urine and flush water with the help of a rotating disc mechanism.

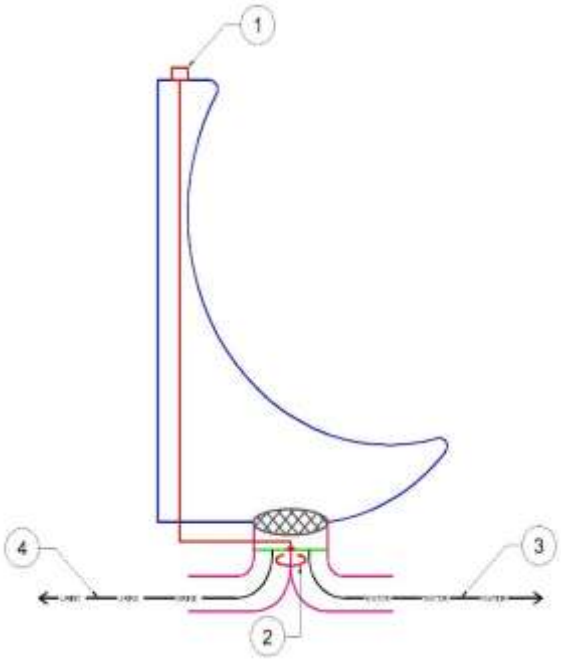

Figure.1 Redesigned Urinal Commode

1 Rotating Knob,
2 Rotating Disc mechanism,
3 Flush water directed to sewage&
4 Urine directed to storage system.

While urinating the person operates the rotating knob (1) and he will make sure that the urine drain hole is only opened and the flush water drain is closed, similarly, before flushing, using the same rotating knob he will close the urine drain and opens the flush water drain, due to this the flush water will be directed to sewage and the urine will be directed to the urine storage tank through these separate mechanism and piping we will be able to effectively separate both the urine and flush water, thereby reducing the power required for electrolysis of urine as we obtain pure urine only. The figure.2 shows the schematic layout of the urine directed to storage tank (red line) and flush water to sewage (blue line).

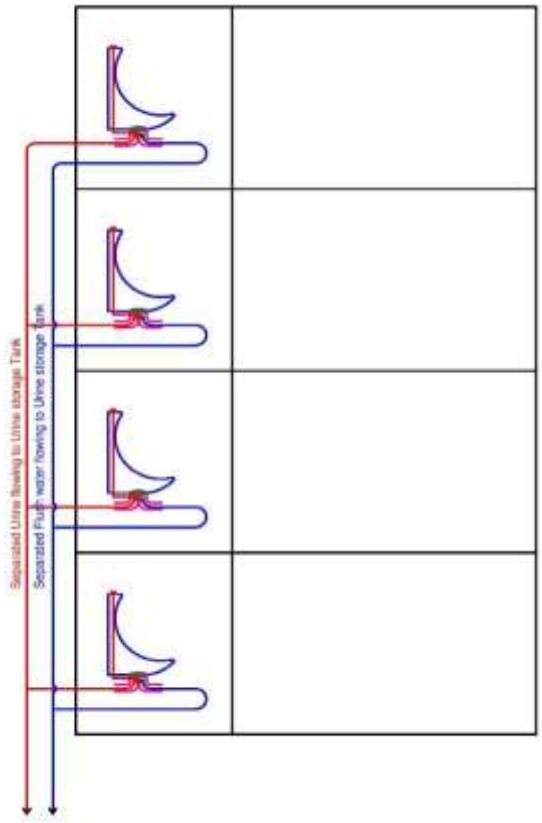

Figure.2

IV) Obtaining Hydrogen Gas through Electrolysis:

The stored urine is then pumped to the electrolytic cell through a set of filters to remove solid particles present in it. When the urine in the electrolytic cell is adequate, power (electricity) is supplied to the cell through the batteries that are charged by the solar panels. On providing the electric power, the urea, the main integral of urine gets adsorbed on to the nickel electrode surface, which passes the electrons needed to break up the molecule.Clean hydrogen is evolved at the cathode, while nitrogen plus a trace of oxygen and hydrogen were collected at the anode. While carbon-dioxide is generated during the reaction, none is found in the collected gasses as it reacts with the potassium hydroxide in the solution to form potassium carbonate. The entire process can be represented through the following chemical reactions that take place at the Anode & Cathode respectively:

Reaction at Anode:
$CO(NH_2)2 + 6OH^- \text{----->} N_2 + 5H_2O + CO_2 + 6e^-$
Reaction at Cathode:
$6H_2O + 6e^- \text{-----> } 3H_2 + 6OH^-$
Complete Reaction:
$CO(NH_2)2 + H_2O \text{-----> } N_2 + 3H_2 + CO_2$

The hydrogen obtained at cathode goes into a water filter for purification, which then gets pushed into the gas cylinder.The gas cylinder pushes hydrogen into a cylinder of liquid borax, which is used to eliminate the moisture from the hydrogen gas. For the entire process to be completed we need only a voltage of 0.37 V when compared with 1.23V needed to split the hydrogen atoms present in the water, this is because the four Hydrogen atoms present in urine are pretty loosely bonded than the Hydrogen atoms in the water (H_2O) and this voltage is supplied through the batteries that will be charged through solar panels. This purified hydrogen gas is then used for fueling car and for other domestic needs. Figure.3 describes the proposed schematic layout of electrolysis of urine powered by solar energy, further purification of hydrogen and its applications.

V) Conclusion:

Since Hydrogen is used as fuel, on combustion the byproduct obtained would be water vapor so this serves as an eco-friendly fuel. The other advantage of this process is that by electrolysis of urine before it gets decomposed into Ammonia we are also eliminating harmful substances from the sewage fluids, the major obstacle for this process would be storing and handling of Hydrogen gas but with the advanced researches we can handle and store the Hydrogen effectively. Since the power to run electrolysis is obtained through solar powered batteries, the proposed working layout would be free from running costs.

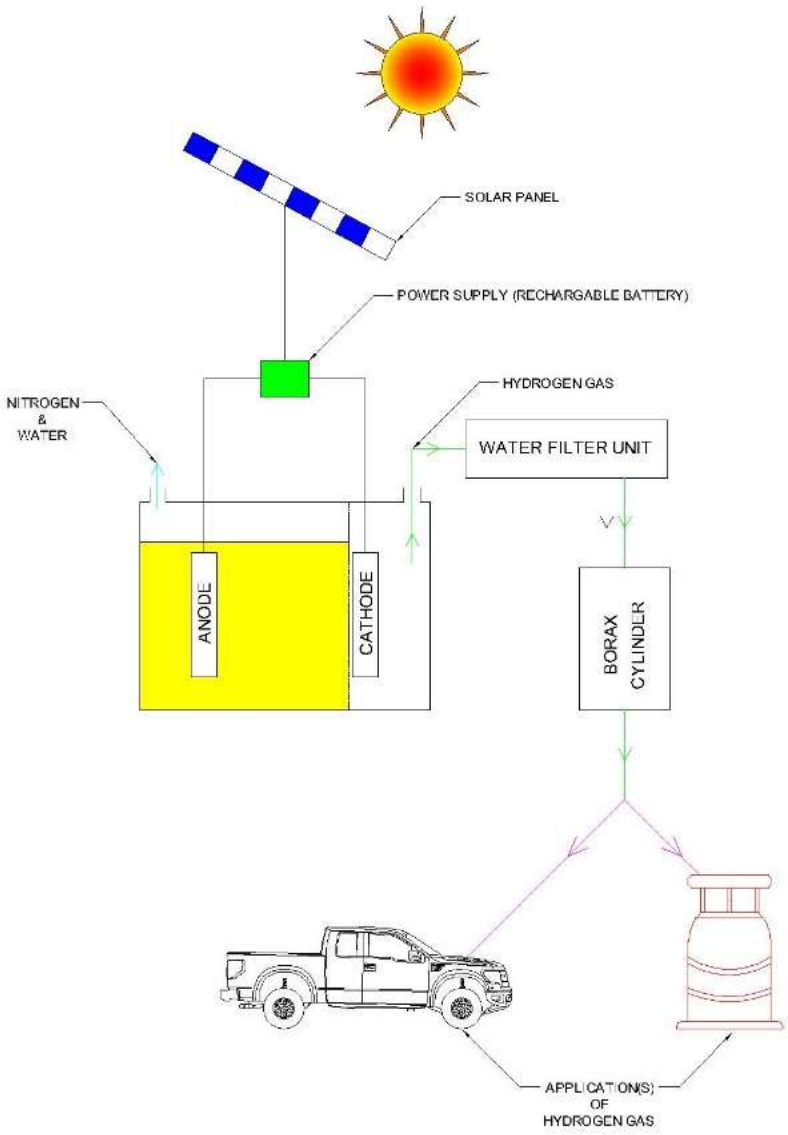

Figure.3

VI) References:

1. Urea Electrolysis: Direct Hydrogen Production from Urine By Bryan K. Boggs, Rebecca L. King and Gerardine G. Botte
2. Electrolysis of Urea and Urine for Solar Hydrogen By Jungwon Kima, Won Joon K. Choib, Jina Choia, Michael R. Hoffmanna, Hyunwoong Park.
3. http://www.rsc.org/chemistryworld/News/2011/October/31101103.asp
4. https://www.ohio.edu/engineering/ceer/research/urea.cfm

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